Applicant's Environmental Report – Operating License Renewal Stage

Millstone Power Station Units 2 and 3

Dominion Nuclear Connecticut

Docket No. 50-336

License No. DPR-65

Docket No. 50-423

License No. NPF-49

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ACRONYMS AND ABBREVIATIONS

AAGR	annual average growth rate
AQCR	Air Quality Control Region
CDEP	Connecticut Department of Environmental Protection
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CL&P	Connecticut Light and Power Company
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DNC	Dominion Nuclear Connecticut
DPUC	Department of Public Utility Control
DSM	demand-side management
EPA	U.S. Environmental Protection Agency
ESF	Engineered Safeguards Features
°F	degrees Fahrenheit
FES	Final Environmental Statement
FWS	U.S. Fish and Wildlife Service
GEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants
gpm	gallons per minute
IPA	Integrated Plant Assessment
kV	kilovolt
LIS	Long Island Sound
MOS	margin of safety
MPS	Millstone Power Station
MSA	metropolitan statistical area
msl	mean sea level
MW	megawatt
MWe	megawatts-electric

MWt	megawatt-thermal
NEPA	National Environmental Policy Act
NESC®	National Electrical Safety Code®
NMFS	National Marine Fisheries Service
NNEC	Northeast Nuclear Energy Company
NOAA	National Oceanic and Atmospheric Administration
NO_x	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NSPS	new source performance standards
NU	Northeast Utilities
OPM	Office of Policy Management
ppm	parts per million
SAMA	Severe Accident Mitigation Alternatives
SCR	selective catalytic reduction
SHPO	State Historic Preservation Office
SMITTR	surveillance, monitoring, inspections, testing, trending, and recordkeeping
SO_2	sulfur dioxide
SO_x	oxides of sulfur
TSP	total suspended particulates
USCB	U.S. Census Bureau
USFWS	U.S. Fish and Wildlife Service
WPCA	Water Pollution Control Authority

1.0 INTRODUCTION

1.1 Purpose of and Need for Action

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants in accordance with the Atomic Energy Act of 1954, as amended, and NRC implementing regulations. Dominion Nuclear Connecticut Inc. (DNC), a wholly-owned, indirect subsidiary of Dominion Resources, Inc., operates Millstone Power Station Units 2 and 3, hereafter referred to as Millstone Power Station (MPS), pursuant to NRC Operating Licenses DPR-65 and NPF-49, respectively. The license for Unit 2 will expire July 31, 2015 and the license for Unit 3 will expire November 25, 2025. DNC has prepared this environmental report in conjunction with its application to NRC to renew the MPS Units 2 and 3 operating licenses, as provided by the following NRC regulations:

> Title 10, Energy, Code of Federal Regulations (CFR), Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, Section 54.23, Contents of Application-Environmental Information (10 CFR 54.23) and
>
> Title 10, Energy, CFR, Part 51, Environmental Protection Requirements for Domestic Licensing and Related Regulatory Functions, Section 51.53, Postconstruction Environmental Reports, Subsection 51.53(c), Operating License Renewal Stage [10 CFR 51.53(c)].

NRC has defined the purpose and need for the proposed action, the renewal of the operating license for nuclear power plants such as MPS, as follows:

> "...The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and, where authorized, Federal (other than NRC) decision makers." (Ref. 1.1-1, 28472)

The renewed operating license would allow an additional 20 years of plant operation beyond the current MPS licensed operating period of 40 years.

1.2 Environmental Report Scope and Methodology

NRC regulations for licensing of nuclear power plants require environmental review of applications to renew operating licenses. The NRC regulation 10 CFR 51.53(c) requires that an applicant for license renewal submit with its application a separate document entitled Applicant's Environmental Report - Operating License Renewal Stage. In determining what information to include in the MPS Environmental Report, Dominion has relied on NRC regulations and the following supporting documents:

- NRC supplemental information in the Federal Register (Ref. 1.1-1, Ref. 1.2-1, Ref. 1.2-2, and Ref. 1.2-3)
- Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (Ref. 1.2-4 and Ref. 1.2-5)
- Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses (Ref. 1.2-6)
- Public Comments on the Proposed 10 CFR Part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response (Ref. 1.2-7)
- Supplement 1 to Regulatory Guide 4.2, Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating Licenses (Ref. 1.2-8)

Dominion has prepared Table 1-1 to verify conformance with regulatory requirements. Table 1-1 indicates where the environmental report responds to each requirement of 10 CFR 51.53(c). In addition, each responsive section is prefaced by a boxed quote of the regulatory language and applicable supporting document language.

Table 1-1.
Environmental Report Responses to License Renewal Environmental Regulatory Requirements.

Regulatory Requirements		Responsive Environmental Report Section(s)
10 CFR 51.53(c)(1)		Entire Document
10 CFR 51.53(c)(2), Sentences 1 and 2	3.0	Proposed Action
10 CFR 51.53(c)(2), Sentence 3	7.2.2	Environmental Impacts of Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(1)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(2)	6.3	Unavoidable Adverse Impacts
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(3)	7.0	Alternatives to the Proposed Action
	8.0	Comparison of Environmental Impacts of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(4)	6.5	Short-Term Use Versus Long-Term Productivity of the Environment
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(5)	6.4	Irreversible and Irretrievable Resource Commitments
10 CFR 51.53(c)(2) and 10 CFR 51.45(c)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.2	Mitigation
	7.2.2	Environmental Impacts of Alternatives
	8.0	Comparison of Environmental Impacts of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(d)	9.0	Status of Compliance
10 CFR 51.53(c)(2) and 10 CFR 51.45(e)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.3	Unavoidable Adverse Impacts
10 CFR 51.53(c)(3)(ii)(A)	4.1	Water Use Conflicts (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a Small River with Low Flow)
	4.6	Groundwater Use Conflicts (Plants Using Cooling Water Towers or Cooling Ponds and Withdrawing Makeup Water from a Small River)
10 CFR 51.53(c)(3)(ii)(B)	4.2	Entrainment of Fish and Shellfish in Early Life Stages
	4.3	Impingement of Fish and Shellfish

Table 1-1.
Environmental Report Responses to License
Renewal Environmental Regulatory Requirements. (Cont.)

Regulatory Requirements		Responsive Environmental Report Section(s)
	4.4	Heat Shock
10 CFR 51.53(c)(3)(ii)(C)	4.5	Groundwater Use Conflicts (Plants Using >100 gpm of Groundwater)
	4.7	Groundwater Use Conflicts (Plants Using Ranney Wells)
10 CFR 51.53(c)(3)(ii)(D)	4.8	Degradation of Groundwater Quality
10 CFR 51.53(c)(3)(ii)(E)	4.9	Impacts of Refurbishment on Terrestrial Resources
	4.10	Threatened or Endangered Species
10 CFR 51.53(c)(3)(ii)(F)	4.11	Air Quality During Refurbishment (Non-Attainment Areas)
10 CFR 51.53(c)(3)(ii)(G)	4.12	Microbiological Organisms
10 CFR 51.53(c)(3)(ii)(H)	4.13	Electric Shock from Transmission-Line-Induced Currents
10 CFR 51.53(c)(3)(ii)(I)	4.14	Housing Impacts
	4.15	Public Utilities: Public Water Supply Availability
	4.16	Education Impacts from Refurbishment
	4.17	Offsite Land Use
10 CFR 51.53(c)(3)(ii)(J)	4.18	Transportation
10 CFR 51.53(c)(3)(ii)(K)	4.19	Historic and Archeological Resources
10 CFR 51.53(c)(3)(ii)(L)	4.20	Severe Accident Mitigation Alternatives
10 CFR 51.53(c)(3)(iii)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.2	Mitigation
10 CFR 51.53(c)(3)(iv)	5.0	Assessment of New and Significant Information
10 CFR 51, Appendix B, Table B-1, Footnote 6	2.6.2	Minority and Low Income Populations

1.3 References

Ref. 1.1-1 NRC (U.S. Nuclear Regulatory Commission). 1996. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." Federal Register. Vol. 61, No. 109. June 5.

Ref. 1.2-1 NRC (U.S. Nuclear Regulatory Commission). 1996. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Correction." Federal Register. Vol. 61, No. 147. July 30.

Ref. 1.2-2 NRC (U.S. Nuclear Regulatory Commission). 1996. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." Federal Register. Vol. 61, No. 244. December 18.

Ref. 1.2-3 NRC (U.S. Nuclear Regulatory Commission). 1999. "Changes to Requirements for Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Final Rules." Federal Register. Vol. 64, No. 171. September 3.

Ref. 1.2-4 NRC (U.S. Nuclear Regulatory Commission). 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants. Volumes 1 and 2. NUREG-1437. Washington, DC. May.

Ref. 1.2-5 NRC (U.S. Nuclear Regulatory Commission). 1999. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS). Section 6.3, Transportation and Table 9-1, Summary of findings on NEPA issues for license renewal of nuclear power plants. NUREG-1437. Volume 1, Addendum 1. Washington, DC. August.

Ref. 1.2-6 NRC (U.S. Nuclear Regulatory Commission). 1996. Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses. NUREG-1440. Washington, DC. May.

Ref. 1.2-7 NRC (U.S. Nuclear Regulatory Commission). 1996. Public Comments on the Proposed 10 CFR Part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response. Volumes 1 and 2. NUREG-1529. Washington, DC. May.

Ref. 1.2-8 NRC (U.S. Nuclear Regulatory Commission). 2000. Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating licenses. Supplement 1 to Regulatory Guide 4.2. Washington, DC. September.

2.0 SITE AND ENVIRONMENTAL INTERFACES

2.1 Location and Features

Millstone Power Station (MPS) is located in Waterford, Connecticut, on Millstone Point between the Niantic and Thames Rivers. The nearest large cities are New Haven, approximately 40 miles to the west, and Hartford, approximately 40 miles to the northwest. The site sits on the edge of Long Island Sound and Niantic Bay and is approximately 20 miles west of Rhode Island. Figures 2-1 and 2-2 are MPS 50-mile and 6-mile vicinity maps, respectively.

The site is approximately 525 acres (see Figure 2-3) including the developed area that is approximately 220 acres. In addition to the two units that are the subject of this environmental report, the site includes the shutdown Unit 1 reactor described in Section 2.12. Other features of the site include a natural area (approximately 50 acres), and ballfields licensed to the Town of Waterford (approximately 30 acres). In all, about 300 acres are outside the land developed for the power station. The transmission lines that connect MPS to the New England grid along with the switchyard equipment are owned and maintained by the Connecticut Light and Power Company.

The exclusion area coincides with the site property boundary. The nearest residences are approximately 2,400 feet from the reactors (Ref. 2.1-1, Section 2.1.1.3). The region within six miles of the site includes parts of the towns of Waterford, New London, Groton, East Lyme and Old Lyme.

Prior to development as a power facility, Millstone Point was the site of a granite quarry that operated for approximately two centuries, until 1960 (Ref. 2.1-2, Section 1.2). Construction on Unit 1 began in 1966, on Unit 2 in 1970 and on Unit 3 in 1974. Facility features include reactor containment buildings, auxiliary buildings, intake and discharge structures, turbine buildings, radwaste facility, fuel handling buildings, switchyard and associated transmission lines, an environmental laboratory and training facilities (see Figure 3-1).

Topography consists of low rolling hills inland of the site. Maximum height above mean sea level within 3 miles of the site is 250 feet, and on the site is approximately 80 feet (Ref. 2.1-2, Section 2.7.1.2). The site is underlain by Monson gneiss and Westerly granite. Glacial soils, comprised of rock fragments from clay size particles to boulders as much as 3 feet in diameter, cover the site. In some areas fill from the quarry or the construction of the MPS overlies the glacial materials (Ref. 2.1-2, Section 2.4). The area surrounding MPS is mixed use, consisting of towns and villages, interspersed with some agricultural land, industrial facilities and undeveloped areas.

Section 3.1 describes key features of MPS, including reactor and containment systems, cooling and auxiliary water systems, and transmission facilities.

2.2 Aquatic Ecological Communities

Introduction

The aquatic resources of the Millstone Point area have been monitored continuously since 1968, when pre-operational baseline studies of phytoplankton, zooplankton, benthic organisms, and fish were initiated (Ref. 2.2-1). Studies to determine impacts, if any, of operation of Units 1 and 2 followed in the 1970s, and were summarized in the MPS Clean Water Act Section 316(b) Demonstration (Ref. 2.2-2) and related documents. The Environmental Report – Operating License Stage for Millstone Unit 3 (Ref. 2.2-3), originally submitted to the NRC in 1983, reviewed and summarized pre-operational and operational monitoring studies of impacts of Unit 1 and Unit 2 operation through 1980. In addition to these monitoring studies, which examined the abundance and distribution of a variety of marine organisms, more focused investigations of fish were carried out in support of the 1993 and 2001 cooling water intake feasibility studies (Ref. 2.2-4; Ref. 2.2-5) performed at the request of the Connecticut Department of Environmental Protection. The cooling water intake feasibility studies focused on impacts of impingement and entrainment at Millstone Power Station, and considered strategies for mitigating these impacts.

Millstone Environmental Laboratory scientists have documented aquatic populations over a relatively broad span of time. In the years since the monitoring began, several important laws and regulations were enacted (e.g., the Clean Water Act and associated NPDES programs), the Long Island Sound Study was initiated (in 1985), and the Comprehensive Conservation and Management Plan for Long Island Sound was issued (in 1994) (Ref. 2.2-6).

The section that follows summarizes the findings of studies conducted at Millstone since the mid-1970s. It relies heavily on the Millstone Annual Report 2002 (Ref. 2.2-7), prepared by the Millstone Environmental Laboratory. The Millstone annual reports are a comprehensive source of information on aquatic communities in the Millstone area. These annual reports have been prepared every year since 1975 and submitted to the Connecticut Department of Environmental Protection and the Connecticut Siting Council. In addition to up-to-date information on aquatic communities in the Millstone area, the 2002 Annual Report contains useful information on MPS operations and a chronology of “major construction and operations events,” beginning with groundbreaking for the station in December 1965.

The Site

MPS is located on Millstone Point, about 5 miles west-southwest of New London on the Connecticut shore of Long Island Sound (see Figure 2-2). Millstone Point is bounded to the west by Niantic Bay, to the east by Jordan Cove, and to the south by Twotree Island Channel. Sections 2.1 and 2.4 describe the MPS site and environs.

Strong tidal currents are characteristic of eastern Long Island Sound (Ref. 2.2-8) and predominate in the area of MPS. Velocities of currents in the Millstone area generally range between 0.5 and 2.0 feet per second (Ref. 2.2-2), and are slightly higher in Twotree Island Channel than in the immediate vicinity of Millstone Point and in Niantic Bay. Tidal currents are relatively weak in Jordan Cove and the Upper Niantic River (Ref. 2.2-7). The currents are driven by semi-diurnal tides that have a mean and maximum range of 2.6 and 3.3 feet, respectively (Ref. 2.2-7).

The movement of water at Millstone Point at flood tide is toward the west, but circulation is less clearly defined in upper Niantic Bay and Jordan Cove (Ref. 2.2-2). With the ebb tide, currents flow eastward past Millstone Point. The mean tidal flow in Twotree Island Channel is approximately 120,000 cubic feet per second (Ref. 2.2-2). Mean tidal exchange for Niantic Bay is approximately 100,000 cubic feet per second. Direction and magnitude of tidal flow vary considerably depending upon the stage of the tide. Signell et al. (Ref. 2.2-9) describe tides, tidal currents, and circulation patterns in LIS, and consider ways in which these physical processes influence the characteristics and distribution of sea-floor sediments.

Salinity in LIS in the area of MPS ranges from 26 to 32 parts per thousand and averages around 29 parts per thousand, slightly less than the salinity of open ocean, which is normally around 35 parts per thousand (Ref. 2.2-10). Surface water temperatures in the area of the MPS intake range from 31ºF in January-February to around 78ºF in August-September. Based on vertical salinity and temperature profiles taken in Twotree Island Channel and Niantic Bay, this portion of LIS is “very thoroughly mixed” by wind and currents, with no indication of stratification beyond some minor warming of surface waters (Ref. 2.2-10).

Lobster Studies at MPS

The American lobster (*Homarus americanus*), found in the northwest Atlantic from Labrador to Cape Hatteras, supports a commercial fishery in New England. Maine, Massachusetts and Long Island Sound (Connecticut and New York) have historically ranked first, second, and third, respectively, in the U.S. in pounds of lobsters landed annually. In the 1980s and 1990s, lobster landings in Long Island Sound increased substantially, peaking in 1998, when 3.7 million pounds of lobster were landed in Connecticut alone (Ref. 2.2-7, viii).

Because of the social and economic importance of the American lobster, the population in the vicinity of MPS has been studied extensively since 1978 (Ref. 2.2-7, viii). The total number of lobsters caught each year from May through October at three sampling stations in the area of MPS ranged from 1,824 in 1978 to 11,438 in 1992 (Ref. 2.2-7, 179). Catch per unit effort, a normalized value that takes into consideration the number of pots fished, ranged from 0.855 in 2002 to 2.560 in 1999 (Ref. 2.2-7, 179).

The most notable change in the population characteristics of local lobsters has been the increase in the proportion of egg-bearing females and a decrease in the size of females at sexual maturity. From 1978 through 1990, between 3.1 and 7.8 percent of females were egg bearing (Ref. 2.2-7, 184). The percentage of egg-bearing females increased sharply after 1990, to 15.3 percent in 1992 and 16.0 percent in 1993. Since that time, the percentage has ranged from 10.4 (in 1996) to 14.9 percent (in 2001). In recent years, there has also been a reduction in the size at which females become sexually mature. It is unclear whether this is related to changes in environmental conditions (increasing bottom seawater temperatures) or intense fishing pressure (Ref. 2.2-7, 185). There has been an increasing trend in bottom seawater temperatures since 1979 (Ref. 2.2-7, 185) and an almost eight-fold increase in number of lobster pots fished in New York and Connecticut over the same time period.

Small size at maturity and egg production from sub-legal-sized females may explain why LIS lobsters appear to be resilient to high levels of fishing pressure (Ref. 2.2-7, 185). Currently, the small size at sexual maturity allows females to spawn 1 or 2 times before reaching the legal size, possibly sustaining current population levels into the future.

Beginning in late 1998, lobsters in western Long Island Sound began showing signs of disease; declines followed in 1999. These declines have been attributed to a parasitic paramoeba (a protozoan) that infected lobster nerve tissue, effectively paralyzing the animals (Ref. 2.2-11). At the same time, lobsters in eastern LIS were being affected by a bacterial infection commonly known as “shell disease.” The cumulative effect of the two disease outbreaks was severe: lobster landings in Connecticut plummeted from 3.7 million pounds in 1998 to 1.1 million pounds in 2002, a 70 percent decline (Ref. 2.2-7, viii).

The Long Island Sound Lobster Research Initiative was established by NY/CT Sea Grant in July 2000 to research the causes of the decline and monitor stock recovery Ref. 2.2-12). Research on direct and indirect causes of the lobster decline is ongoing, and strategies for aiding the recovery of the LIS lobster population(s) are being discussed by state and federal resource agencies. As of 2002, the precipitous decline in lobster abundance observed elsewhere in LIS has not been seen in the area of MPS, although abundance in the area experienced a less severe decline (Ref. 2.2-7, ix)

However, the impact of the lobster decline in western LIS and the widespread occurrence of shell disease in eastern LIS still threaten the Connecticut stock. It should be noted that numbers of lobster larvae collected in the immediate vicinity of MPS were very low in 2002. If larvae found in the MPS area are spawned in western LIS, this may be an indication that recruitment (i.e., the addition of young of harvestable size to a population) has been affected by the disease outbreaks. The impact of this (apparent) reduction in recruitment may not be known for several years, because larvae produced in 2002 will not be vulnerable to capture in traps until they are several years old (Ref. 2.2-7, ix).

Rocky Intertidal Communities

The intertidal communities on rocky shores of Long Island Sound are characterized by three horizontal bands of barnacles and different species of algae (Ref. 2.2-13). Zonation is dependent on tidal fluctuations (which result in varying durations of dessication), exposure to wave action, seasonal variations, and other factors. As a result, the intertidal community in the area consists of hundreds of different species of algae, along with grazers, such as periwinkles, and other members of this community. The algae of the intertidal zone are an important source of food for snails, crabs and other benthic invertebrates, as well as fish and shorebirds.

Rocky intertidal studies have been performed around MPS since 1968. These studies have shown no impact on rocky shore communities due to plant operation, with the exception of the shore immediately adjacent to the discharge. In this area, for a distance of up to 150 meters to the east, the studies have identified a slight shift in algal populations from cold-water species toward warm-water species (Ref. 2.2-7, ix).

Benthic Infauna

Marine benthic invertebrates are organisms that live on or in the sea bottom. They are important components of coastal ecoystems because they serve as a food source for larger macroinvertebrates (lobsters) and demersal fish (spot and winter flounder) and because their activities (feeding, burrowing, and tube building) tend to promote nutrient recycling and oxygenate sediments (Ref. 2.2-7). Diverse and thriving benthic infaunal communities are generally indicative of healthy coastal marine ecosystems.

Subtidal benthic infaunal communities have been monitored since 1980 at two locations in the immediate vicinity of the station (intake and effluent areas), at Jordan Cove, and at a reference station approximately four miles to the west (Giants Neck) of MPS. Although there has been considerable year to year variation, total abundance of organisms has generally been highest at the Jordan Cove station (19 of 23 years) and lowest at the Intake station (16 of 23 years) (Ref. 2.2-7, 241 and Ref. 2.2-14, 45). Collections at all stations tended to be dominated by annelids (polychaetes and oligochaetes), with arthropods (chiefly amphipods) and molluscs making up a relatively small percent of the total.

Eelgrass

Eelgrass (*Zostera marina*) is a rooted flowering plant that is found in shallow coastal waters, often growing in dense beds known as “eelgrass meadows.” Eelgrass beds provide a matrix or physical structure for marine biological communities, creating diverse habitats where there would otherwise be only shifting sands. Eelgrass beds provide cover and shelter for a variety of juvenile fish and shellfish. Eelgrass is also eaten by waterfowl, including black brant, Canada geese, black ducks, and scaup.

Once widespread in southern New England, eelgrass beds were devastated in the 1930s by a wasting disease caused by (depending on the authority cited) a bacterium, a fungus, a slime mold, or environmental stressors (e.g., increased water temperatures) (Ref. 2.2-15, Ref. 2.2-16). Eelgrass beds showed signs of recovery in the mid-1940s, but the recovery was hampered by post-war development along the Atlantic coast that resulted in increased levels of point-source and non-point source pollutants in coastal waters (Ref. 2.2-17). Sediment from construction sites smothered eelgrass beds, while increased nutrient levels (from fertilizers, septic systems, and sewage treatment plant effluents) produced algae blooms that reduced water clarity and hindered photosynthesis (Ref. 2.2-15). Because of the importance of eelgrass to shallow coastal ecosystems, state resource agencies (with technical and financial support from NOAA-NMFS) from Maine to Virginia began working in the 1980s to protect surviving eelgrass beds and re-establish eelgrass beds in areas from which they had been eliminated (Ref. 2.2-18; Ref. 2.2-19; Ref. 2.2-20).

Because of the species' importance, eelgrass beds in the area of MPS have been monitored since 1985. Eelgrass beds (sampling stations) in Jordan Cove and White Point have been consistently sampled since 1985. A reference station was established in the Niantic River in 1985, but the loss (die-off) of eelgrass beds has forced Millstone Environmental Laboratory scientists to relocate this station five times.

Although experiencing small declines in some of the parameters measured (shoot length and biomass), the eelgrass beds nearest MPS have survived as generally healthy populations over the course of the study. The eelgrass beds in the Niantic River, on the other hand, intended as reference sites outside of the influence of MPS, have fared poorly.

Finfish

Finfish sampling programs at MPS have been designed to monitor long-term trends in abundance of local fish populations, detect significant changes in these populations, and determine if any such changes are related to station operation. Current programs include sampling of ichthyoplankton (fish eggs and larvae), demersal fish, and shore-zone fish. Ichthyoplankton are sampled in the power station discharge; demersal fish are sampled with an otter trawl at stations near the Intake, in the Niantic River, and in Jordan Cove; shore-zone fish are sampled by haul seine from shallow waters of Jordan Cove. The results of 26 years of fish sampling are presented in the 2002 Millstone Environmental Laboratory Annual Report (Ref. 2.2-7) and summarized here.

A total of 123 fish taxa was recorded as eggs, larvae, juveniles, or adults from collections made over the June 1976 through May 2002 monitoring period (Ref. 2.2-7). This total includes 58 taxa enumerated in ichthyoplankton samples, 49 taxa taken by seine, and 112 taxa taken by trawl.

Anchovies (mostly bay anchovy, *Anchoa mitchilli*) accounted for almost half (41 percent) of the larvae collected at the MPS discharge station from June 1976 through May 2002 (Ref. 2.2-7, 134). Winter flounder (*Pseudopleuronectes americanus*) represented approximately 14 percent of the larvae collected over the same period. Atlantic menhaden (*Brevoortia tyrannus*) made up 16 percent of the larvae collected over the study period. Other species routinely collected as larvae over the 1976-2002 period were American sand lance (*Ammodytes americanus*, 6.6 percent of total), grubby (*Myoxocephalus aenaeus*, 5.3 percent), rock gunnel (*Pholis gunnellus*, 2.5 percent), cunner (*Tautogolabrus adspersus*, 2.2 percent), and tautog (*Tautoga onitis*, 2.3 percent). Most of the eggs collected were those of cunner (53 percent of total), tautog (27.3 percent), and anchovies (4.6 percent) (Ref. 2.2-7, 134).

Silversides (*Menidia menidia* and *M. beryllina*) consistently dominated shore-zone collections from 1976-2002, making up 80 percent of all fish captured by haul seine over the 26-year period. Striped killifish and mummichog (*Fundulus majalis* and *F. heteroclitus*, respectively) were second in abundance, making up 10 percent of the total. In the late 1990s, however, Atlantic menhaden numbers increased dramatically in collections. In 1998-99, 1999-2000, and 2000-2001, Atlantic menhaden made up 38.3, 29.9, and 21.5 percent of these collections. This trend did not continue in 2002, when few menhaden were collected (Ref. 2.2-7).

More than 59 percent of the fish collected in trawl samples from the intake station (*Niantic Bay*) from 1976-2002 were winter flounder and scup (*Stenotomus chrysops*) (Ref. 2.2-7, 166). Winter flounder made up 28 percent of fish collected from 1976-2002 and ranked first in collections in 19 of 26 years. Scup made up 31 percent of fish collected and ranked first in 7 of 26 years. Windowpane (*Scopthalmus aquosus*, 7.6 percent), skates (*Raja* spp., 5.9 percent), silversides (5.5 percent), and cunner (3.3 percent) were also frequently collected.

Winter flounder and scup were the most common species in trawl catches at the Jordan Cove station over the 1976-2002 period. Winter flounder constituted 25.7 percent of fish collected at this station, while scup were 18.9 percent. Other species taken in trawls included silversides (8.2 percent of total), cunner (5.5 percent), rock gunnel (5.1 percent), anchovies (4.6 percent), skates (4.1 percent), cods (3.8 percent), windowpane (3.2 percent), and grubby (3.0 percent).

Winter flounder have accounted for approximately 64 percent of all fish collected at the Niantic River station since 1976. Silversides, grubby, windowpane, summer flounder (*Paralichthys dentatus*), and northern pipefish (*Syngnathus fuscus*) have also been collected regularly at this station. Numbers of tautog and scup in Niantic River trawl samples were somewhat high in 2000-2001 and 2001-2002, when they ranked third and fourth in

collections. It is unclear whether this marks a change in the pattern of abundance at this station or is an anomaly.

Overall, long-term abundance trends of finfish around MPS are consistent with the trends for those species elsewhere in their ranges.

Winter Flounder

Extensive studies of winter flounder have been carried out at MPS since 1973, including winter surveys of adult spawners in the Niantic River, winter-spring surveys of larvae, and spring-summer surveys of age-0 (young-of-the-year) fish (Ref. 2.2-7). In addition, the long-term entrainment studies and the trawl surveys of demersal fishes have yielded useful information on the population dynamics of winter flounder.

Abundance of winter flounder peaked in the MPS area in the early 1980s and decreased thereafter, most likely from a variety of causes (Ref. 2.2-7, 19-21). Similar declines in abundance of winter flounder have been seen throughout Long Island Sound and southern New England.

More specifically, winter flounder have localized spawning stocks and of primary interest is the stock that spawns in the Niantic River. On average, a winter flounder female spawns an estimated 500,000 eggs per year in winter. Winter flounder eggs have limited dispersal because they adhere to the bottom after spawning. Therefore, almost no eggs are flushed from the Niantic River and entrained at MPS. However, winter flounder larvae reside in the water column during their 40- to 60-day development period and are susceptible to tidal flushing out of the Niantic River and from other spawning areas. Some of these larvae are subject to entrainment at MPS during late spring. MPS studies have demonstrated that a significant proportion of the larvae entrained annually at MPS did not originate from the Niantic River, but from other spawning stocks in Long Island Sound, such as those associated with nearby tidal rivers. (Ref. 2.2-21; Ref. 2.2-7). Losses to more distant populations are considered less critical because larvae swept into coastal waters have reduced survival probability compared to those individuals reentering natal estuaries or nursery areas.

MPS conducts impact assessments of winter flounder using a computer model, which simulates winter flounder population dynamics from prior to station operation through the expected operational lifetime of all units to beyond plant operations during a recovery period. It was developed specifically for the effect of MPS on the Niantic River spawning stock. The model predicts changes in population size over time given different mortality sources and plant operational inputs. For example, the model incorporates natural and fishing mortality rates and superimposes the added impacts caused by MPS on various life stages, including larvae that are entrained and juveniles and adults that are impinged. MPS's Modeling results

indicated that the decline in the Niantic River winter flounder population was primarily due to overfishing, with a relatively smaller fraction attributed to station operation. The Connecticut Department of Environmental Protection is reviewing issues related to the decline of Niantic River winter flounder as part of Millstone's water discharge permit renewal process discussed in Chapter 4, and a staff member of its Marine Fisheries Division has prepared a report entitled "Impact of Three Unit Operation at the Millstone Power Station on Winter Flounder in the Niantic River" which questions certain modeling assumptions. These matters will be addressed in the proceedings on Millstone's application for renewal of its water discharge permit.

Large-scale, regional reductions in winter flounder have been observed in LIS, Southern New England and throughout the northeast, with overfishing given as the primary reason by state and federal resource agencies. Recent calculations show that the Niantic River population represents less than 2 percent of the winter flounder resource in Long Island Sound (Ref. 2.2-7, 113).

Annual estimates of entrainment of winter flounder by MPS in 2000 and 2001 were relatively high, reflecting high larval populations in Niantic Bay (Ref. 2.2-14, xii). The estimate for 2002 was lower, reflecting lower larvae densities, and reduced cooling water demand by MPS during the larvae season (Ref. 2.2-7, vi). However, correlations between entrainment estimates and abundance of age-0 juveniles were positive, implying that higher entrainment rates are associated with higher numbers of larvae surviving to become post-larvae and juveniles. It remains to be seen whether this trend will result in increased numbers of spawning adults.

As indicated above, other factors or combinations of factors may slow growth of the Niantic Bay winter flounder population. These include recreational and commercial harvest of adults (overfishing), the trend to warmer winters and higher water temperatures that affect the survival of early life history stages through changes in predator abundance and activity, impaired water quality (due to nutrient loading and chemical pollutants), loss of nursery habitat (eelgrass die-off in Niantic River), and possible increased predation on young flounder by fishes and cormorants.

2.3 Groundwater Resources

Millstone lies in the Seaboard Lowland section of the New England physiographic province. A layer of basal till blankets the site. The bedrock surface is irregular and has been smoothed by the action of glaciers. The groundwater table is highest in the northern part of the site and slopes gradually to the shoreline (Ref. 2.1-1, Section 2.5.1).

Prior to opening the quarry to Long Island Sound, the depth of water in the quarry was 17 feet below the level of the Sound. This quarry was worked for almost 200 years at a distance of only 200 feet from the Sound without a noticeable inflow of water. The permeabilities of the bedrock and the overlying soils are extremely low with little or no groundwater or seawater seepage (Refs. 2.1-2, 2.5.1 and 2.5.2).

There were two shallow wells in the northern part of the site, used to irrigate the ballfields, and to supply concession stands at the fields. In 2001 the concession stands were connected to a municipal water supply. One of the two wells was filled in and abandoned. The second well is used on a seasonal basis for irrigating the ballfields (Ref. 2.3-1). Based on the depth of the well (22 feet), pump horsepower and pumping capacity of pumps with identical horsepower, Dominion has concluded that the capacity is much less than 100 gallons per minute.

2.4 Critical and Important Terrestrial Habitats

The MPS site covers approximately 525 acres (Figure 2-3). The industrial portion of the site comprises approximately 220 acres and consists of the generating facilities, office buildings, warehouses, parking lots, and switchyard.

Natural terrestrial habitats at the site consist of old field, mesic hardwood forest, coastal marsh, and beach. Although they are not "natural" habitats, a transmission line corridor and picnic area at the site also provide habitat for wildlife and plants. Brief descriptions of each of these six habitats are provided below, and are based on a field survey conducted at MPS in 1999 (Ref. 2.4-1, 3-16).

An old field community is located in the north-central portion of the site. Formerly mowed periodically, the area has not been mowed for more than 20 years. This has resulted in dense thickets of shrubby species such as the native blackberry (*Rubus* spp.) and two exotics, multiflora rose (*Rosa multiflora*) and Japanese honeysuckle (*Lonicera japonica*). An overstory of eastern red cedar (*Juniperus virginiana*), scarlet oak (*Quercus coccinea*), and black cherry (*Prunus serotina*) is gradually developing such that the area will revert to hardwood forest if left undisturbed (Ref. 2.4-1, 3-17).

Mesic hardwood forest comprises the largest natural community on the site. The forest overstory is dominated by a variety of oaks (*Quercus* spp.), as well as pignut hickory (*Carya glabra*), black birch (*Betula lenta*), red maple (*Acer rubrum*), and American beech (*Fagus grandifolia*). The understory consists of saplings and numerous shrub species (Ref. 2.4-1, 3-17, -18).

A coastal marsh lies along the eastern edge of the site. Dominant plant species consist of salt meadow grass (*Spartina patens*), salt grass (*Distichlis spicata*), Bigelow's glasswort (*Salicornia bigelovii*), seaside goldenrod (*Solidago sempervirens*), and smooth cordgrass (Spartina alterniflora) (Ref. 2.4-1, 3-19).

Few plant species are generally found on beaches, due to harsh conditions such as wave and tidal influences, salt spray, greatly varying soil and ambient air temperatures, and strong winds. The beach habitat at MPS is no exception. Beach grass (*Ammophila breviligulata*) dominates the beach zone. Toadflax (*Linaria vulgaris*), evening primrose (*Oenothera biennis*), seaside goldenrod, and jimsonweed (*Datura stramonium*) were also present with increasing distance from the water's edge (Ref. 2.4-1, 3-22).

The 500-foot wide transmission line corridor at MPS was initially cleared in 1968, and within a few years had been colonized by a wide variety of herbaceous and woody pioneer species. More than 30 years of periodic mowing and herbicide treatment have converted the corridor into a habitat that is now similar to the early stages of an old field habitat. Plant species consist mostly of numerous shrubs, grasses, and sedges (Ref. 2.4-1, 3-19, -20).

An area at Bay Point on Niantic Bay is maintained as an open area. Much of this area consists of periodically mowed grass. However, various native and ornamental trees and shrubs occur in portions of the picnic area, resulting in what could be classified as young hardwood forest (Ref. 2.4-1, 3-21).

The habitats described above support a variety of wildlife species typical of similar habitats in New England. The abundant mast produced by the oak-hickory forest provides food for upland species such as white-tailed deer, gray squirrel, and wild turkey. Forest openings and the old field habitat support mammals such as the cottontail rabbit, red fox, and woodchuck. The MPS site supports various songbirds and birds of prey and is located on the Atlantic Coast flyway for migratory birds. The coastal marshes at MPS provide habitat for waterfowl such as the mallard, blue-winged teal, ringneck duck, and Canada goose (Ref. 2.4-1, 3-23), as well as wading birds such as herons (Ref. 2.2-10, 4-13). Osprey nest platforms have been maintained at MPS since 1967. From 1969 to 2003, 179 young osprey have been produced on these platforms. Currently, there are nine osprey nest platforms at MPS; four platforms contained active nests during the 2003 breeding season. The osprey is a Connecticut species of special concern.

DNC maintains a 50-acre wildlife refuge in the eastern portion of the MPS site. Extending from Jordan Cove northward into mesic hardwood forest, the wildlife refuge provides habitat for a variety of wildlife species. Ponds in this area are used by waterfowl such as wood ducks, common mergansers, and black ducks, as well as herons and egrets.

Several small vernal pools are located east of the transmission corridor within the mesic hardwood forest at MPS. These small depressions fill with melting snow and spring rain. The drying of these pools each year precludes fish populations in them. The absence of predatory fish allows the pools to be used by species that are dependent on vernal pools for their survival (e.g., mole salamanders and wood frogs). The vernal pools are also used by species such as spotted turtles, spring peepers, and a variety of invertebrates (Ref. 2.4-1, 3-24).

Section 3.1.3 describes the four transmission lines that were constructed to connect MPS to the transmission system. Two lines connected Unit 1 and the other two lines connected Units 2 and 3. All four transmission lines run northward from the plant in a common corridor (415 to 500 feet wide) for 9.1 miles to Hunts Brook Junction. At Hunts Brook Junction, the lines diverge, with two lines running north to the Card and Manchester Substations, one line running east to the Montville Station, and one line running west to the Southington Substation. These four lines share corridors with other previously existing transmission lines.

A field survey of a 16-mile portion of the Southington transmission corridor was recently conducted to determine the types of vegetative habitats present (Ref. 2.4-2). A variety of

habitats were found. Abandoned fields dominated by large shrub species were the most prevalent vegetation type with 43 percent of the pole-to-pole segments along the corridor. Grass/forb cover dominated 28 percent of the segments. Wetlands (shrub swamps and shallow marshes) dominated 11 percent of the segments. Abandoned fields dominated by small shrub species dominated 10 percent of the segments. Other cover types included pasture, crops, sapling forest, and poletimber forest. The sapling and poletimber forests occurred on steep ravine slopes; conductor wires in these areas are high above the treetops because the lines are typically situated between poles situated on each side of the ravine (Ref. 2.4-2). Although similar habitat surveys have not been conducted along other MPS-associated transmission corridors, the habitat types along the other corridors are comparable to those within the 16-mile portion of the Southington transmission corridor described above.

No areas designated by the U.S. Fish and Wildlife Service (FWS) as “critical habitat” for endangered species occur at MPS or along the associated transmission corridors. The transmission corridors do not cross any federal parks. The Millstone-Card Street/Manchester corridor traverses the Pease Brook Wildlife Management Area. The Southington corridor, which is the longest of the MPS-associated transmission corridors, traverses Nehantic State Forest and Cockaponset State Forest, as well as Hartman Park, a largely forested park owned by the town of Lyme.

The Connecticut Light and Power Company (CL&P) controls vegetation within the four MPS-associated transmission corridors through the use of a “two-zone maintenance” concept. The “wire zone” consists of the area directly beneath the overhead conductors extending 15 feet outward from the outermost conductor. The “side zone” extends from the wire zone edge to the edge of the corridor (Ref. 2.4-3, 1, 2). Generally, most tree species and tall brush species are removed from the wire zone, resulting in areas of grasses, forbs, and brush species. However, scattered pockets of red cedar (*Juniperus virginiana*) are maintained to create nesting sites and cover for wildlife species that tend to avoid open land. In addition, some tree species are allowed on steep slopes such as ravines and hillsides. Low-growing trees (e.g., dogwood) and shrubs (e.g., sumac, witchhazel) are encouraged in the side zones, and where shrub/tree height is maintained at multiple levels. This multi-layered edge is a transition zone between the forest edge and the grass/forb/shrub habitat beneath the conductors. The transition zone provides structural diversity and quality wildlife habitat while not interfering with the transmission of electricity. It also provides a “bridge” to forest interior species that are averse to crossing open areas due to predation (Ref. 2.4-2, 9; Ref. 2.4-4, 16, 17, 43).

CL&P controls undesirable vegetation through the integrated use of manual cutting, mechanical mowing, side trimming, and herbicide treatment. Herbicides are not used within

10 feet of water bodies or wetlands (Ref. 2.4-3, 2-5). Mowing of the corridors is conducted only from November through April for three primary reasons: (1) to minimize potential adverse impacts to wetlands from mowing equipment, because wetland edges become especially mucky after summer thunderstorms, (2) to avoid disturbing nesting birds and other wildlife reproduction activities, and (3) to coincide with the dormant season for many fruiting vegetation species that are important wildlife food sources (e.g., blueberries, blackberries) (Ref. 2.4-5). Prior to carrying out vegetation management in transmission corridors, CL&P submits project work plans to the Connecticut Department of Environmental Protection (CDEP) to determine whether CDEP data indicate that threatened or endangered species occur along the corridor and if the impending work will potentially impact the threatened or endangered species. If applicable, CL&P then works with CDEP to produce a management plan designed to protect the relevant species. CL&P environmental personnel review work plans with maintenance crews to ensure that sensitive species, sensitive plant communities, and wetland areas are protected (Ref. 2.4-6).

2.5 Threatened or Endangered Species

Species that are state- or federally-listed as threatened or endangered are known to occur, at least occasionally, in the vicinity of the MPS site and transmission corridors (Table 2-1). In addition, nine marine species (the shortnose sturgeon, three species of whale and five species of sea turtle) listed by the USFWS and National Marine Fisheries Service (NMFS) could occur in Long Island Sound in the vicinity of MPS (Table 2-1).

Roseate terns (*Sterna dougallii dougallii*), state- and federally-listed as endangered, nest in colonies on sand/gravel beaches or pebbly/rocky offshore islands along the Atlantic coast. Eggs are laid in shallow scrapes, or depressions, sometimes lined with dried vegetation. Nests are often concealed by vegetation or rocks (Ref. 2.5-1). DNC is not aware of any roseate tern nesting attempts at MPS. However, roseate terns use Fox Island (actually a peninsula in the southeast portion of the MPS site) as a stopover area during fall migrations. Fox Island is treated as a tern sanctuary in the fall, with access strictly controlled. Least terns (*Sterna antillarum*), state-listed as threatened, have been observed by MPS employees on or near the MPS site during migration. The northeastern U.S. population of least terns is not federally listed, although the interior U.S. population (i.e., within the Mississippi River watershed) is federally listed as endangered. DNC is not aware of any least tern nesting attempts at MPS.

Bald eagles (*Haliaeetus leucocephalus*), which are state-listed as endangered and federally threatened but under consideration for delisting, have been observed foraging during winter on the Niantic River, several miles northwest of the MPS Site. Sightings of single bald eagles near the MPS site have been reported by MPS employees on two occasions in recent years. There are no known bald eagle nests in the vicinity of the MPS site or along the transmission corridors.

The great egret (*Ardea albus*) and snowy egret (*Egretta thula*) are state-listed as threatened. Both species are commonly observed along the Connecticut shoreline, and are seen from late spring to early fall in the ponds of the wildlife area on the MPS site. DNC is not aware of any egret nesting attempts at MPS.

Yellow-breasted chats (*Icteria virens*), Connecticut-listed as endangered, were observed from 1986 through 1988 approximately two miles north of MPS along the common corridor of the four transmission lines that originate at MPS and diverge at Hunts Brook Junction (Ref. 2.5-8). They have also been observed by MPS employees on or near the MPS site during migration. The yellow breasted chat is a bird of thickets and overgrown fields, where it nests 2-8 feet above ground in bushes or vines (Ref. 2.5-2).

Two protected anadromous fish species, the shortnose sturgeon (*Acipenser brevirostrum*) and the Atlantic sturgeon (*Acipenser oxyrhynchus*), are found in the Connecticut River and

parts of Long Island Sound. Shortnose sturgeon are federally- and state-listed in Connecticut as endangered. An estimated 1,200 to 1,500 shortnose sturgeon are found in freshwater and estuarine portions of the Connecticut River and are presumed to range into adjacent areas of Long Island Sound (Ref. 2.5-3). No shortnose sturgeon has been captured in more than 30 years of sampling at MPS. Atlantic sturgeon, state-listed as threatened in Connecticut fresh waters, occur in the lower reaches of the Connecticut River and certain areas of Long Island Sound (Ref. 2.5-4). One Atlantic sturgeon was captured in a trawl sample near MPS in 1980, and was released unharmed by Millstone Environmental Laboratory biologists.

The right whale (*Balaena glacialis*), finback whale (*Balaenoptera physalus*), and humpback whale (*Megaptera novaeangliae*), all federally listed as endangered, pass south of Long Island during seasonal migrations and are occasionally observed in Long Island Sound (Ref. 2.5-5; Ref. 2.5-6). DNC is not aware of any observations of whales in the waters off MPS.

Five species of sea turtle occur along the mid-Atlantic coast (Table 2-1) (Ref. 2.5-6), but sightings are uncommon and limited for the most part to sub-adult “wanderers”. Young sea turtles occasionally enter Long Island Sound and are sometimes stranded on the north shore of Long Island (Ref. 2.5-7). MPS personnel have rarely observed sea turtles in the waters off MPS, and none are known to have been stranded at MPS.

A population of tall nut sedge (*Scleria triglomerata*), a state endangered species, is located approximately 11 miles from MPS and 2 miles north of Hunts Brook Junction on the Card/Manchester transmission corridor. This is the only population observed in New England within the past five years (Ref. 2.5-8).

The Seabeach sandwort (*Honkenya peploides*), a state special concern species, is found on site in approximately six locations. These populations are stable and well-established, and are in areas not subject to disturbance by site-related activities.

Finally, as is the case for the entire Connecticut coastline, MPS is located on migration routes for numerous bird species. As such, state-listed bird species are occasionally observed during spring and fall migrations on and near MPS by employees who are amateur birders. These include the sharp-shinned hawk (*Accipiter striatus*), Northern harrier (*Circus cyaneus*), peregrine falcon (*Falco peregrinus*), vesper sparrow (*Pooecetes gramineus*), and pied-billed grebe (*Podilymbus podiceps*), all of which are state-listed as endangered, as well as the Cooper’s hawk (*Accipiter cooperii*), which is state-listed as threatened.

2.6 Demography

2.6.1 Regional Demography

The GEIS presents a population characterization method that is based on two factors: "sparseness" and "proximity" (Ref. 2.6-1, Section C.1.4). "Sparseness" measures population density and city size within 20 miles of a site and categorizes the demographic information as follows:

Demographic Categories Based on Sparseness

		Category
Most sparse	1.	Less than 40 persons per square mile and no community with 25,000 or more persons within 20 miles
	2.	40 to 60 persons per square mile and no community with 25,000 or more persons within 20 miles
	3.	60 to 120 persons per square mile or less than 60 persons per square mile with at least one community with 25,000 or more persons within 20 miles
Least sparse	4.	Greater than or equal to 120 persons per square mile within 20 miles

Source: Ref. 2.6-1, Table C.1.

"Proximity" measures population density and city size within 50 miles and categorizes the demographic information as follows:

Demographic Categories Based on Proximity

		Category
Not in close proximity	1.	No city with 100,000 or more persons and less than 50 persons per square mile within 50 miles
	2.	No city with 100,000 or more persons and between 50 and 190 persons per square mile within 50 miles
	3.	One or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 miles
In close proximity	4.	Greater than or equal to 190 persons per square mile within 50 miles

Source: Ref. 2.6-1, Table C.1.

The GEIS then uses the following matrix to rank the population category as low, medium, or high.

GEIS Sparseness and Proximity Matrix

Sparseness \ Proximity	1	2	3	4
1	1.1	1.2	1.3	1.4
2	2.1	2.2	2.3	2.4
3	3.1	3.2	3.3	3.4
4	4.1	4.2	4.3	4.4

Low Population Area	Medium Population Area	High Population Area

Source: Ref. 2.6-1, Table C.1.

DNC used 2000 census data from the U.S. Census Bureau (USCB) website (Ref. 2.6-2) and geographic information system software (ArcView®) to determine demographic characteristics in the MPS vicinity. The Census Bureau provides updated annual projections, in addition to decennial data, for selected portions of its demographic information.

As derived from 2000 USCB information, 303,620 people live within 20 miles of MPS. Applying the GEIS sparseness measures, MPS is located in an area with a population density of 296 persons per square mile of land within 20 miles and falls into the least sparse category, Category 4 (greater than or equal to 120 persons per square mile within 20 miles).

As estimated from 2000 USCB information, 2,868,207 people live within 50 miles of MPS. This equates to a population density of 567 persons per square mile of land. Applying the GEIS proximity measures, MPS is classified as Category 4 (greater than or equal to 190 persons per square mile within 50 miles). According to the GEIS sparseness and proximity matrix, the MPS ranks of sparseness, Category 4, and proximity, Category 4, result in the conclusion that MPS is located in a high population area.

All or parts of 15 counties, the City of Hartford, and sections of the Hartford and the New London-Norwich Metropolitan Statistical Areas (MSA) are located within 50 miles of MPS (Figure 2-1). Four states fall within the 50 mile radius of MPS with a distribution as follows:

8 counties in Connecticut, 4 counties in Rhode Island, 2 counties in Massachusetts and 1 county in New York. Approximately 73 percent of the station employees reside in New London County, Connecticut. The remaining 27 percent are distributed across 21 counties, with numbers ranging from 1 to 176 employees per county.

The Hartford MSA ranks 42nd in population size with 1,183,110 residents (Ref. 2.6-3). The New London-Norwich MSA, which contains New London County, is characterized by rural, seasonal, and suburban areas, with a total population of 293,566, making it the 134th largest MSA in the United States (Ref. 2.6-3).

The population within a 10-mile radius of MPS increases seasonally as a result of an influx of approximately 10,500 summer residents. Many of the beaches and recreation areas are used by non-residents resulting in a population shift during the summer months. (Ref. 2.4-1). Other area establishments attract daily visitors throughout the year.

Based on distribution of employees at MPS, New London County has the greatest potential to be socioeconomically affected by license renewal activities at MPS (see Section 3.4). New London County has been growing at a rate similar to the State of Connecticut. From 1970 to 2000, Connecticut's and New London County's average annual population growth rates were 0.41 and 0.42 percent (Ref. 2.6-4 and Ref. 2.6-2), respectively.

Within New London County, three towns have the largest numbers of employees. The towns and their 2000 populations are Waterford (19,152), East Lyme/Niantic (18,118), and Colchester (14,551).

Table 2-2 shows populations, estimated population projections, and annual growth rates for the State of Connecticut and New London County. Between the years 2000 and 2040, the population of New London County is projected to increase at an average annual rate of 0.42 percent (Ref. 2.6-5). For the same period the population of Connecticut is projected to grow at an average annual rate of 0.38 percent, (Ref. 2.6-5).

2.6.2 Minority and Low-Income Populations

Background

When NRC performed environmental justice analyses for previous license renewal applications, NRC used a 50-mile radius as the overall area that could contain environmental impact sites and the state as the geographic area for comparative analysis. DNC has adopted this approach for identifying the MPS minority and low-income populations that could be affected by MPS operations.

DNC used ArcView® geographic information system software to combine U.S. Census Bureau (USCB) TIGER line data with USCB 2000 census data to determine the minority characteristics by block group and low-income characteristics by census tract. DNC

included any census tract/block group if any of its area lay within 50 miles of MPS. The 50-mile radius includes 2,320 block groups and 726 census tracts. The geographic area for MPS is one of four states: Connecticut, Massachusetts, New York, or Rhode Island.

2.6.2.1 **Minority Populations**

The NRC Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues (Ref. 2.6-6, Appendix D) defines a “minority” population as: American Indian or Alaskan Native; Asian; Native Hawaiian or other Pacific Islander; Black races; other; multi-racial; the aggregate of all minority races; or Hispanic ethnicity. The guidance indicates that a minority population exists if either of the following two conditions exists:

1. The minority population of the census block or environmental impact site exceeds 50 percent.
2. The minority population percentage of the environmental impact area is significantly greater (typically at least 20 points) than the minority population percentage in the geographic area chosen for comparative analysis.

NRC guidance calls for use of the most recent U.S. Census Bureau decennial census data. DNC used 2000 census data in determining the percentage of the total population within the four states for each minority category, and in identifying minority populations within 50 miles of MPS.

To calculate each minority percentage, DNC divided USCB population numbers for each minority population within each block group. For each of the 2,320 block groups within 50 miles of MPS, DNC calculated the percent of the population in each minority category and compared the result to the corresponding geographic area’s minority threshold percentages to determine whether minority populations exist. DNC defines the geographic area for MPS as the state of Connecticut when the block group is within Connecticut, Massachusetts when the block group is within Massachusetts, New York when the block group is within New York, and Rhode Island when the block group is within Rhode Island.

Connecticut contains the largest portion of the environmental impact sites at 76.6 percent of the block groups. USCB data (Ref. 2.6-7) characterizes Connecticut as 0.3 percent American Indian or Alaskan Native; 2.4 percent Asian; 0.0 percent Native Hawaiian or other Pacific Islander; 9.1 percent Black races; 4.3 percent all other single minorities; 2.2 percent multi-racial; 18.4 percent aggregate of minority races; and 9.4 percent Hispanic ethnicity. Rhode Island has the second largest environmental impact area at 14.8 percent of the block groups.

USCB data (Ref. 2.6-8) characterizes Rhode Island as 0.5 percent American Indian or Alaskan Native; 2.3 percent Asian; 0.1 percent Native Hawaiian or other Pacific Islander; 4.5 percent Black races; 5.0 percent all other single minorities; 2.7 percent multi-racial; 15.0 percent aggregate of minority races; and 8.7 percent Hispanic ethnicity. New York has 8.3 percent of the block groups. USCB data (Ref. 2.6-9) characterizes New York as 0.4 percent American Indian or Alaskan Native; 5.5 percent Asian; 0.0 percent Native Hawaiian or other Pacific Islander; 15.9 percent Black races; 7.1 percent all other single minorities; 3.1 percent multi-racial; 32.1 percent aggregate of minority races; and 15.1 percent Hispanic ethnicity. Massachusetts has 0.002 percent of the block groups. USCB data (Ref. 2.6-10) characterizes Massachusetts as 0.2 percent American Indian or Alaskan Native; 3.8 percent Asian; 0.0 percent Native Hawaiian or other Pacific Islander; 5.4 percent Black races; 3.7 percent all other single minorities; 2.3 percent multi-racial; 15.5 percent aggregate of minority races; and 6.8 percent Hispanic ethnicity.

Based on the “more than 20 percent” or the “exceeds 50 percent” criteria, no Native Hawaiian or other Pacific Islander or Multi-racial minorities exist in the geographic area. Table 2-3 presents the number of block groups within each county that exceed the threshold for minority populations.

Based on the “more than 20 percent” criterion, American Indian or Alaskan Native minority populations exist in two block groups in Suffolk County, NY (Figure 2-4).

Based on the “more than 20 percent” criterion, an Asian minority population exists in five block groups (Table 2-3). All of these block groups are in the state of Connecticut; three in New Haven, one in Hartford County and the fifth in Tolland County (Figure 2-5).

Based on the “more than 20 percent” criterion, Black Races minority populations exist in 193 block groups (Table 2-3), 189 of which are located in the state of Connecticut. These block groups are distributed among five counties; New Haven with 103 block groups, Hartford with 80 block groups, New London with 4 block groups, and Tolland and Middlesex with 1 block group each. Two of the remaining four block groups are in Suffolk County, New York and the other two in Rhode Island: one in Newport and one in Providence county (Figure 2-6).

Based on the “more than 20 percent” criterion, an All Other Single Minority Races population exists in 88 block groups (Table 2-3), all in Connecticut. These block groups are distributed among four counties; Hartford with 52 block groups, New

Haven with 31 block groups, Windham with 4 block groups, and New London with 1 block group (Figure 2-7).

Based on the "more than 20 percent" criterion, Aggregate of Minority Races populations exist in 331 block groups (Table 2-3). Connecticut has 325 block groups, and New York and Rhode Island have 3 each (Figure 2-8).

Based on the "more than 20 percent" criterion, Hispanic Ethnicity minority populations exist in 169 block groups (Table 2-3). Connecticut has 168 of the block groups distributed among 4 counties; Hartford (83 block groups), New Haven (76 block groups), Windham (6 block groups), and New London (3 block groups). The remaining block group is in Suffolk County, New York (Figure 2-9).

The minority populations identified are predominantly in ethnic neighborhoods in Hartford and New Haven, approximately 40 miles from MPS. As shown in Figures 2-4 through 2-9, very few census blocks identified as minority populations under the environmental justice criteria, occur in closer proximity to the site.

2.6.2.2 **Low-Income Populations**

NRC guidance defines "low-income" by using U.S. Census Bureau statistical poverty thresholds (Ref. 2.6-6, Appendix D). U.S. Census Bureau (Ref. 2.6-11) characterizes 7.99 percent of Connecticut, 9.89 percent of Massachusetts, 14.02 percent of New York, and 12.44 percent of Rhode Island households as low-income.

For each census tract within the 50-mile radius (see Section 2.6.2.1 for a discussion of how census tracts were selected and population percentages were calculated), the number of low-income households was divided by the number of total households in that census tract to obtain the percent of low-income households for that tract. A low-income population is considered to be present if:

1. The low-income population of the census tract exceeds 50 percent, or
2. The percentage of households below the poverty level in a census tract is significantly greater (typically at least 20 points) than the low-income population percentage in the geographic area chosen for comparative analysis.

Based on the "more than 20 percent" criterion, 55 census tracts contain low-income populations (Ref. 2.6-12). Fifty-four of these tracts are in Connecticut and the other one is in Rhode Island (Table 2-3). Figure 2-10 locates the low-income household tracts, which are predominantly in Hartford and New Haven, both approximately 40 miles from MPS.

2.7 Taxes

MPS pays annual taxes to the towns of Waterford and East Lyme, both located in New London County. The majority of tax payments are made to Waterford ($13.5 million in 2002). East Lyme receives a small tax payment for the Plant's Information and Science Center ($5,332 in 2002). Because the tax payment to East Lyme is small, this section will focus on Waterford tax revenues only.

Tax revenues fund Waterford's General Fund which supports programs such as school systems, libraries, public works, public health programs, emergency management services, fire departments, parks and recreation, planning and land use commissions, the police department, the Retirement Commission, and others (Ref. 2.7-1).

For the assessment years 1996 to 1999, MPS' taxes provided 64 to 69 percent of Waterford's total tax revenues. However, due to the electric power industry restructuring enacted in Connecticut in 1998, MPS' tax payments have decreased markedly. Plant values are now assessed using fair market value instead of net book value methodologies. Because MPS was sold to DNC in 2001, a fair market value assessment has been relatively easy to obtain. Due to a change in the method of assessment related to utility restructuring, MPS' property tax payments dropped from an average of $34 million per year between 1996 and 1999 to $11.6 million in 2000. As a part of restructuring, the State legislature passed a program called the Systems Benefit Charge which is designed to, among other things, reimburse any affected towns for the revenue loss created by the change in assessment methodologies for electric power utilities (Ref. 2.7-2). The Connecticut Department of Public Utility Control (DPUC) directs the state electric distribution companies to fund the program and the Connecticut Office of Policy and Management (OPM) oversees it (Ref. 2.7-2). The program operates on a graduated schedule, reducing reimbursements 10 percent annually over 10 years, allowing towns to locate other sources of revenue and adjust budgets gradually. In 2000, MPS' tax payments represented approximately 36 percent of Waterford's tax revenues before the Systems Benefit Charge reimbursement. The reimbursement amount was $21,818,848 (Ref. 2.7-2). Eventually (as the program phases out), revenues will be recouped through millage rate increases and budget adjustments (Ref. 2.7-2). Table 2-4 compares MPS' tax payments to Waterford's total tax revenues from 1996 to 2000.

DNC cannot accurately project what MPS' annual taxes will be during the license renewal period. However, changes to MPS tax rates due to restructuring would be independent of license renewal. Fair assessments of the plant and associated facilities will be determined on an annual basis. In order to determine the difference between what the Town would have received before restructuring and after, Town and MPS officials must calculate a net book value and a fair market value each year. The difference between the two will be submitted to the OPM and DPUC, who will determine the reimbursement amount (Ref. 2.7-2). Because

the Town must recoup the revenues lost from the change in assessment methodologies through increased millage rates (and budget adjustments), plant millage rates will increase over time (Ref. 2.7-2). The town would have MPS in its tax base for an additional 20 years as a result of license renewal. It is also logical to assume that MPS, during the license renewal period, would provide stable, predictable tax revenues for the Town of Waterford.

2.8 Land Use Planning

MPS is located in the town of Waterford, a suburban community that consists primarily of owner-occupied single-family dwellings. Waterford is one of 21 municipalities that comprise New London County. There are no unincorporated areas within the county, and land use planning within Connecticut is performed at the municipal level. Connecticut municipalities have formed regional planning organizations to respond to governmental challenges such as land use planning. For these purposes, 20 of the New London County municipalities formed the Southeastern Connecticut Council of Governments. Information about Connecticut municipalities and their planning organizations is available on the state website (Ref. 2.8-1).

The Atomic Energy Commission (AEC), predecessor to the U.S. Nuclear Regulatory Commission, characterized land use at the time of MPS construction in the following manner (Ref. 2.8-2, Section 2.2):

> Except for the towns of Groton, New London and Norwich, the general character of land use in the plant area is scattered villages and homes. In the Southeastern Connecticut planning region, 86 percent of the land area is classified as undeveloped.

This characterization remains generally true today. State data indicate that land use within the Southeastern Connecticut Council of Governments planning region is 10 percent urban. Approximately 67 percent of the land use in the region is forest, with agriculture accounting for 14 percent of the land use. Groton and New London, at 28 and 66 percent urban, respectively, are more developed areas.

Figure 2-11 shows the location of Waterford and its neighboring municipalities and summarizes land usage. Waterford, located adjacent to New London, is 18 percent urban. Agriculture land use in Groton, New London, and Waterford is slightly below the regional average but all three show that urbanization has come at the expense of forest as a land use; while Waterford remains 60 percent forest, Groton is 48 percent and New London only 11 percent forest. The other three municipalities abutting Waterford, East Lyme, Montville, and Ledyard, reflect successively less urbanization and more retention of forest land use. Generally, the more developed areas are located on the coastline. Table 2-5 provides additional land use details.

The validity of the AEC land use characterization is reflected in the relatively slight population growth rates in the area. Since 1980, New London County has had an annual average growth rate of only 0.4 percent. The Waterford population growth rate is exactly the same as the county's, 0.4 percent. Groton and New London have lost population, while Colchester, East Lyme, Ledyard, and Montville have gained population. Groton and New London, combined, have a population of slightly more than 65,000, and Waterford adds another 19,000. Table 2-6 provides population numbers and growth rates for these areas.

Connecticut statutes require communities to have plans of conservation and development (Ref. 2.8-3, 2, 3). Some, like Waterford, have regulations for lot sizes and restrictions on multi-family development densities (Ref. 2.8-3, Chapter 8). However, plans for the municipalities where most MPS employees live (discussed in Section 3.4) do not show evidence of having, or having plans for, the kind of growth controls that would severely restrict housing availability (Ref. 2.8-3, Chapter 8; Ref. 2.8-4, Chapter 3; Ref. 2.8-5, Chapter 9).

2.9 Social Services and Public Facilities

2.9.1 Public Water Supply

Because MPS is located in New London County and most of the MPS employees reside in New London County, the discussion of public water supply systems will focus on three municipalities in New London County where the greatest number of employees live – Waterford, East Lyme/Niantic, and Colchester (as discussed in Section 2.6.1), – and the City of New London, which supplies water to Waterford and provides potable water to MPS. Table 2-7, however, contains public water supply data for the entire county of New London. MPS acquires potable water from the City of New London. MPS's 2000-2001 potable water usage averaged 332,000 gallons per day. This usage represents approximately 5.2 percent of the City of New London's daily capacity (see Table 2-7) and 6 percent of the City's average daily use.

The State of Connecticut (through the Departments of Environmental Protection and Public Health) imposes standards on all public water suppliers in order to guarantee safe water consumption for all residents. The State requires suppliers to meet adequate margins of safety (MOS) between average water consumption and the safe yield of the system. The safe yield of a water system is the amount of water that can be safely withdrawn, even in a drought year. An MOS is calculated by dividing the average daily supply by the average daily demand. State standards conclude that an adequate margin of safety exists when:

- Safe yield is more than 125 percent of the average consumption, or
- Average consumption is less than 80 percent of the safe yield.

In areas of the state where groundwater is the only source of supply, maintaining a minimum MOS becomes difficult when droughts cause aquifer levels to drop.

The city of New London provides most of the water for the public water supply system in Waterford. The city of New London obtains water from the Lake Konomoc reservoir located in Waterford and Montville (Ref. 2.8-3).

The Waterford water supply system may need to be expanded in the future. State standards indicate that there may not be an adequate margin of safety between average water consumption and the safe yield of the system. As a result, the city of New London is currently searching for additional supply sources for future consumption. An intermunicipal agreement with the city of New London provides that new Waterford customers may be denied service in times of water shortage. As a result, future development in Waterford could be restricted by the water supply system (Ref. 2.8-3).

A number of alternative water supply sources have been and are currently being investigated. Limited study has been done on the diversion of water to Lake Konomoc.

However, Waterford is concerned about the environmental impacts any diversions may have on other resources (i.e., Hunt's Brook and Miller's Pond). Ground water sources also have been investigated in the Jordan Brook and Nevin's Brook watersheds. Providing additional water sources needs to be implemented with some expedience (Ref. 2.8-3). In any event, water conservation is presently and will continue to be encouraged (Ref. 2.8-3).

Another possible solution being considered is the creation of a regional water supply system. The system would be a result of the interconnection of the Norwich, Groton, and New London/Waterford systems. Such a system would possibly provide for additional safe yield and redundant supply sources (Ref. 2.8-3). In any event, water conservation is presently and will continue to be encouraged (Ref. 2.8-3).

Aquifers provide the total current drinking water supply for East Lyme and will continue to do so for the foreseeable future. Approximately 60 percent of the Town is served by public water through the operation of 7 wells located in four stratified drift aquifers. The remaining 40 percent is served by private wells in bedrock aquifers (Ref. 2.8-4). In 1998, due to a limited developed water supply, the Town found it necessary to implement a moratorium on new water connections for subdivisions and commercial establishments. Although the Town has the potential for developing new wells, the water supply is limited (Ref. 2.8-4). The surface waters of the Town are generally safe, but development may degrade their quality. Currently, all municipal well supplies are active and approved for use by the Department of Public Health. Wells 1, 2, 3, and 4 produce the majority of the water for the town. When demand significantly increases, however, Wells 3A and 5 are permitted to meet possible shortfalls (Ref. 2.9-1). In July 2002, the seventh well, Well 6, was put into service (Ref. 2.9-2).

The town is required by the State to maintain a minimum MOS. The peak daily demands are currently being met. However, estimated future demand may compel the Town to seek other sources of water, and water conservation is strongly encouraged (Ref. 2.9-3). Potential future water sources include (Ref. 2.9-1):

- The town owns a 117-acre parcel called the Plants Dam Property on the Four Mile River and is exploring constructing a well at this location.
- Depending on restrictions on Well 3A, East Lyme may construct another well as a replacement for Well 3. Because Well 3 was originally registered for 600 gpm, and aquifer yield has dropped to 300 gpm, a replacement well could be constructed within 250 feet of the original Well 3 without DEP permitting.

- A long-term solution to supply demands may be provided through interconnection with the New London/Waterford system, assuming that its safe yield is augmented through a connection with Groton.

The Colchester Sewer and Water Commission and the Public Works Department manage the public water system in Colchester. Public water is derived exclusively from public wells and service is essentially limited to the center of Colchester where the majority of the commercial and community facilities in town are located (Ref. 2.8-5). The Commission serves a population of approximately 4,500.

Colchester has adequate water supply sources to meet current demand. However, future water consumption is expected to increase and an eventual need for additional water supplies is projected. Several alternatives including additional groundwater options and/or an interconnection with the Norwich Water Department (which accesses the Deep River Reservoir in Colchester) are being explored. Presently, water conservation is encouraged (Ref. 2.8-5).

2.9.2 **Transportation**

Road access to MPS is via the Millstone Access Road, an onsite two-lane paved road with a north-south orientation. The Millstone Access Road intersects with State Route 156 (Rope Ferry Road), a two to four-lane highway, which has a northeast-southwest orientation (see Figure 2-2). Lane numbers vary from two to four, depending on the road's proximity to populated areas. State Route 156 intersects with U.S. 1, which has an east-west orientation in Connecticut. Employees traveling from the towns of New London and Waterford are most likely to use U.S. 1 and State Route 156. Employees traveling from East Lyme and other communities to the west are most likely to use State Route 161 or U.S. 1, and State Route 156. State Route 161 serves as a major feeder to and from I-95 south. When nearing MPS, all employees must use State Route 156 (Figure 2-2).

Waterford's main roadways are Interstates 95 and 395, US 1, and Routes 85, 156, and 32. The major transportation issues in Waterford involve the roadway circulation system and recreational modes of transportation (such as pedestrian ways and bicycle paths) (Town of Waterford 1998). Overall, the community wants to balance traffic needs with community character and environmental impacts (Ref. 2.8-3). One of Waterford's major issues is the provision of adequate vehicular circulation now and in the future given the historic and anticipated growth of traffic volumes, congestion, and accidents. Since only half of the land area in Waterford has been developed, future traffic volumes are projected to increase as new development occurs (Ref. 2.8-3). Specific transportation projects conducted by State

and local authorities that may improve transportation issues that could impact MPS are listed below (Ref. 2.8-3):

1. Intersection improvements on U.S. 1
2. The widening of westbound Route 156 to two lanes in the vicinity of U.S. 1 to minimize traffic conflicts between intersecting and merging traffic
3. Niantic River Road (one of the smaller access roads near MPS) improvements and potential extension

East Lyme serves as the gateway to southeast Connecticut (Ref. 2.8-4). Therefore, the town is geographically and demographically suited for commercial and industrial development (Ref. 2.8-4). Town officials want to ensure that infrastructure systems are safe, efficient, modally balanced, environmentally sensitive, and will support economic development (Ref. 2.8-4). Town officials also emphasize the goal of minimizing the reliance on automobiles and encourage the use of alternate modes of transportation. In order to meet 10-year transportation goals, town officials have proposed a number of improvements that will foster growth and alleviate congestion on the 136 miles of roads in the town (Ref. 2.8-4). Thirty-two of the 136 miles are state-owned and maintained (Ref. 2.8-4). These roads consist of the two major east-west routes (US 1 and Route 156) and the major north-south corridor (Route 161). Proposed improvement projects that have the greatest potential to impact MPS transportation include upgrades of Routes 161 and 156.

The Connecticut Department of Transportation does not maintain level-of-service designations for the roads in the vicinity of MPS (Ref. 2.9-4). Table 2-8 lists roadways in the vicinity of MPS and the annual average number of vehicles per day, as determined by the Connecticut Department of Transportation.

2.10 Meteorology and Air Quality

Appendix F, Severe Accident Mitigation Alternative Analysis, contains site meteorological information. MPS is located in New London County, Connecticut, which is part of the Eastern Connecticut Intrastate Air Quality Control Region (AQCR) (40 CFR 81.183). New London County is designated as a nonattainment area for ozone, classified serious (40 CFR 81.307). New London County is designated as in attainment for all other criteria pollutants (Ref. 2.10-1). The nearby New Jersey-New York-Connecticut AQCR is also designated as nonattainment for ozone.

In July 1997, the U.S. Environmental Protection Agency (EPA) issued final rules establishing new eight-hour ozone and particulate matter standards. On May 14, 1999, the Circuit Court of Appeals for the District of Columbia (D.C. Circuit) remanded the revised ozone standard to EPA for reevaluation. On February 27, 2001 the U.S. Supreme Court upheld the eight-hour ozone standard, but ordered EPA to reconsider its implementation policy and remanded the case to the D.C. Circuit for proceedings consistent with its opinion (66 FR 57268, November 14, 2001). EPA issued a final response on January 6, 2003 providing justification for the proposed eight-hour ozone standard and a revised proposed implementation policy on June 2, 2003 (68 FR 32801).

The State was required to submit to EPA its recommendations for 8-hour ozone non-attainment areas by July 15, 2003. Based on the latest 3 years of available 8-hour ozone measurements (2000-2002), New London County exceeds the 8-hour standard and will be included in the recommended list of areas to be designated non-attainment. EPA will make the final designations (based on 2001-2003 data) in April 2004. Final designations under the new fine particulate standard will not occur until late 2004. Preliminary data indicate that New London County is meeting the annual fine particulate standard (based on 2000-2002 data).

2.11 Historic and Archaeological Resources

Area History in Brief

Uncertainty shrouds the details of the earliest dwellers in what is now Waterford. While there is no evidence of human life in the local area before the glaciers retreated for the final time, no dates can be set for the coming of the Native Americans. The New England coastal region, roughly Boston to New York, is regarded by scholars as the most densely populated section of eastern North America in aboriginal times, with what is now the state of Connecticut having the largest concentration, although that population was probably no more than approximately 6,000 (Ref. 2.11-1).

The Nehanticks (Niantics) hunted and fished from the Connecticut River eastward to the vicinity of the Narragansetts, who lived in what is now Rhode Island. Not long before 1600, another group from the larger Algonquin tribe, the Pequots, came overland from their native upstate New York through Massachusetts to the local area. This tribe settled in the area around what is now the city of New London and eastward, dividing the Nehanticks into western and eastern branches. For most of the time of unwritten history, the Nehanticks occupied the area around Waterford. In 1672 the Nehanticks were placed on a 300-acre reservation in what was later East Lyme (Ref. 2.11-1).

In 1614, Adriaen Block was the first European to settle in what is now Connecticut. He claimed the Hartford area for the Dutch, who built a fort there in 1633. That same year, the English displaced the Dutch and claimed the area under the sovereignty of England. In 1644, the colony of Massachusetts issued a land grant to John Winthrop, Jr., who established farm plots in the Waterford area in 1651. Agriculture (dairy, poultry, and subsistence farming) dominated the area. Waterford was incorporated in 1801, and by the 1830's, granite quarries and paper mills comprised a large portion of the economy. Manufacturing, research facilities, energy production, and defense contractors comprise a large portion of the town's present day economy (Ref. 2.11-1).

Initial Operation

The Final Environmental Statement (FES) for operation of MPS Unit 3 (Ref. 2.2-10) listed 17 properties on the National Historic Register within the 6-mile radius of MPS. (The Unit 2 FES [Ref. 2.8-2, 2-5, -6] mentions but does not name "a number of notable houses and buildings.") In the FES for Millstone Unit 3, NRC reported that "historic, architectural, and archaeological resources ...will not be affected by the operation of Millstone Unit 3" (Ref. 2.2-10). This statement was supported by a letter from Mr. John W. Shannahan, State of Connecticut Historic Preservation Officer, dated January 5, 1981 Ref. 2.2-10).

Current Status

As of 2002, the National Register of Historic Places lists 181 locations in New London County, Connecticut (Ref. 2.11-2). Of these 181 locations, 62 fall within a 6-mile radius of MPS. Table 2-9 lists the 62 National Register of Historic Places sites within the 6-mile radius of MPS.

In 1998, an archaeological survey was performed for the town of Waterford, Connecticut, including MPS property, by the Public Archaeology Survey Team, Inc. (PAST, Inc.). The main objectives of the survey were to assemble an inventory of prehistoric (i.e., pre-European contact) and historic (i.e., post-European contact) period archaeological sites and areas of potential archaeological sites, and to make recommendations for cultural resource management such as preservation, nomination to the National Register of Historic Places, designation as local historic sites or districts, or other action (Ref. 2.11-3).

The town of Waterford had 19 prehistoric sites recorded in the Office of State Archaeology Records. The PAST survey identified 12 additional prehistoric sites. For those artifacts that could be assigned to a precise location, site numbers were assigned (Ref. 2.11-3).

The town of Waterford had four historic period sites recorded in the Office of State Archaeology Records. The PAST survey identified 73 additional historic period sites based on interviews with local historians, document and deed searches, and a walking survey of potentially historic areas. The identified areas ranged from stone foundations and associated artifacts and abandoned cemeteries to Revolutionary War Militia training fields (Ref. 2.11-3).

Other Historic Sites of Interest

In addition to the locations listed in the National Register of Historic Places and the sites that were identified in the town-wide archaeological assessment survey, other historic sites exist within the 6-mile radius of MPS. The Connecticut Historical Commission lists the Point Historic District in Groton and the Pequot Colony Historic District in New London as other historic sites of interest.

The quarry village schoolhouse, identified in the PAST survey as part of the Millstone Quarry sites, remains on DNC property.

2.12 Known and Reasonably Foreseeable Federal and Non-federal Actions

Millstone Unit 1 is on the same site as Units 2 and 3. Unit 1 (Docket No. 50-245) is a shut-down boiling water reactor that operated from 1970 until 1995. Since that time Unit 1 has been maintained in SAFSTOR, (i.e., safe storage with continued surveillance, security and maintenance but without fuel in the reactor). Unit 1 is not part of this license renewal application. DNC plans to maintain Unit 1 in SAFSTOR until Units 2 and 3 permanently cease operations; consequently, there are no cumulative impacts.

There are no other industries that withdraw or discharge large amounts of water from Niantic Bay or the Niantic River. No other electric generating facilities are within 6 miles of MPS. There are no directly related federal project activities that affect renewal of operating licenses.

Table 2-1.
Endangered and Threatened Species that Could Occur At or Near MPS or Along Associated Transmission Lines.

Scientific Name	Common Name	Federal Status[a]	State Status[a]
Mammals			
Balaena glacialis	Right whale	E	-
Balaenoptera physalus	Finback whale	E	-
Megaptera novaeangliae	Humpback whale	E	-
Birds			
Ardea albus	Great egret	-	T
Egretta thula	Snowy egret	-	T
Haliaeetus leucocephalus	Bald eagle	T	E
Icteria virens	Yellow-breasted chat	-	E
Sterna antillarum	Least tern	-	T
Sterna dougallii dougallii	Roseate tern	E	E
Reptiles			
Caretta caretta	Loggerhead sea turtle	T	T
Chelonia mydas	Green sea turtle	T	T
Dermochelys coriacea	Leatherback sea turtle	E	E
Eretmochelys imbricata	Hawksbill sea turtle	E	-
Lepidochelys kempii	Kemp's (Atlantic) ridley sea turtle	E	E
Fish			
Acipenser brevirostrum	Shortnose sturgeon	E	E
Acipenser oxyrhynchus	Atlantic sturgeon	-	T
Plants			
Scleria triglomerata	Tall nut sedge (nutrush)	-	E

a. E = Endangered; T = Threatened; - = Not listed.

Source: Ref. 2.4-1, Ref. 2.5-5, Ref. 2.5-6, Ref. 2.5-8.

Table 2-2.
Estimated Populations and Annual Growth Rates in the State of Connecticut, and New London County, CT, from 1970 to 2040.

	Connecticut		New London County	
Year	**Number**	**Percent**	**Number**	**Percent**
1970[a]	3,031,709	--	230,348	--
1980[a]	3,107,576	0.25	238,409	0.35
1990[a]	3,287,116	0.58	254,957	0.70
2000[b]	3,405,565	0.36	259,088	0.16
2010[c]	3,533,269	0.37	271,393	0.47
2020[c]	3,663,379	0.37	281,669	0.38
2030[c]	3,793,490	0.36	291,946	0.36
2040[c]	3,923,601	0.34	302,223	0.35

a. Ref. 2.6-4.
b. Ref. 2.6-2.
c. Ref. 2.6-5.

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Table 2-3.
Minority and Low-Income Population Census Data.

County	State	2000 Block Groups	American Indian or Alaskan Native	Asian	Native Hawaiian or other Pacific Islander	Black Races	All Other Single Minorities	Multi-racial Minorities	Aggregate of Minority Races	Hispanic Ethnicity	2000 Census Tracts	2000 Census Tracts Low-Income
Fairfield	CT	27	0	0	0	0	0	0	0	0	14	0
Hartford	CT	604	0	1	0	80	52	0	151	83	205	29
Litchfield	CT	5	0	0	0	0	0	0	0	0	2	0
Middlesex	CT	118	0	0	0	1	0	0	2	0	35	2
New London	CT	191	0	0	0	4	1	0	13	3	182	21
New Haven	CT	645	0	3	0	103	31	0	153	76	63	0
Tolland	CT	96	0	1	0	1	0	0	1	0	26	2
Windham	CT	92	0	0	0	0	4	0	5	6	25	0
Hampden	MA	3	0	0	0	0	0	0	0	0	1	0
Worcester	MA	2	0	0	0	0	0	0	0	0	2	0
Suffolk	NY	193	2	0	0	2	0	0	3	1	59	0
Kent	RI	120	0	0	0	0	0	0	0	0	37	0
Newport	RI	46	0	0	0	1	0	0	2	0	17	0
Providence	RI	87	0	0	0	1	0	0	1	0	32	1
Washington	RI	91	0	0	0	0	0	0	0	0	26	0
TOTAL		2320	2	5	0	193	88	0	331	169	726	55

Table 2-3.
Minority and Low-Income Population Census Data. (Cont.)

State Average										
State	American Indian or Alaskan Native	Asian	Native Hawaiian or other Pacific Islander	Black Races	All Other Single Minorities	Multi-racial Minorities	Aggregate of Minority Races	Hispanic Ethnicity		Low-Income
Rhode Island	0.5%	2.3%	0.1%	4.5%	5.0%	2.7%	15%	8.7%		12.4%
New York	0.4%	5.5%	0.0%	15.9%	7.1%	3.1%	32.1%	15.1%		14.0%
Massachusetts	0.2%	3.8%	0.0%	5.4%	3.7%	2.3%	15.5%	6.8%		9.9%
Connecticut	0.3%	2.4%	0.0%	9.1%	4.3%	2.2%	18.4%	9.4%		8.0%
Percentage that identifies a minority block or low-income tract										
Rhode Island	20.5%	22.3%	20.1%	24.5%	25.0%	22.7%	35%	28.7%		32.4%
New York	20.4%	25.5%	20.0%	35.9%	27.1%	23.1%	52.25%	35.1%		34.0%
Massachusetts	20.2%	23.8%	20.0%	25.4%	23.7%	22.3%	35.6%	26.8%		29.9%
Connecticut	20.3%	22.4%	20.0%	29.1%	24.3%	22.2%	38.5%	29.4%		28.0%

Table 2-4.
Millstone Power Station Tax Payments and Waterford Tax Revenues 1996 – 2000.

Year	Waterford Grand List Tax Revenues[a]	Tax Paid by Millstone Power Station	Percent of Waterford Tax Revenues
1996	$50,310,334	$34,768,749	69
1997	$50,436,903	$34,163,131	68
1998	$50,570,691	$33,495,022	66
1999	$52,548,808	$33,725,414	64
2000	$32,448,775[b]	$11,738,993	36

a. Ref. 2.7-3. Note: Taxes collected after adjustments (such as abatements, etc.). Grand List includes real estate, personal property, and motor vehicle taxes.

b. Assessment year 2000 number does not include the State program reimbursement.

Table 2-5.
Percent Land Uses in the Towns in the Vicinity of MPS.

	Acres (and Percentage)							
Town	**Total**	**Urban**	**Agriculture**	**Forest**	**Barren**	**Water**	**Wetland**	**Other**
Colchester	31,768	2,099 (7)	4,659 (15)	23,616 (74)	356 (1)	528 (2)	428 (1)	82 (0)
East Lyme	22,298	2,845 (13)	2,521 (11)	15,071 (68)	377 (2)	949 (4)	363 (2)	171 (1)
Groton	20,704	5,883 (28)	2,770 (13)	9,891 (48)	251 (1)	1,306 (6)	418 (2)	185 (1)
Ledyard	25,543	2,240 (9)	2,668 (10)	18,884 (74)	161 (1)	1,240 (5)	327 (1)	22 (0)
Montville	28,315	2,915 (10)	3,135 (11)	20,062 (71)	543 (2)	1,442 (5)	186 (1)	31 (0)
New London	3,979	2,640 (66)	378 (10)	426 (11)	11 (0)	478 (12)	13 (0)	32 (1)
Waterford	21,909	4,004 (18)	2,940 (13)	13,206 (60)	126 (1)	1,296 (6)	225 (1)	112 (1)

Source: Ref. 2.8-6.

Table 2-6.
MPS-Vicinity Population.

Region	1980	1990	2000	AAGR[a] 1980-2000
Connecticut	**3,107,580**	**3,287,116**	**3,405,565**	**0.5%**
County				
New London County	238,410	254,957	259,088	0.4%
Town				
Colchester	7,761	10,980	14,551	3.2%
East Lyme	13,870	15,340	18,118	1.3%
Groton	41,072	45,144	39,907	-0.1%
Ledyard	13,725	14,913	14,687	0.3%
Montville	16,455	16,673	18,546	0.6%
New London	28,843	28,540	25,671	-0.6%
Waterford	17,843	17,930	19,152	0.4%

Source: Ref. 2.8-6.

a. AAGR: Annual Average Growth Rate.

Table 2-7.
Major New London County Public Water Supplies and Capacities.

Water Supplier*	Water Source	Average Daily Use (MGD)	Maximum Capacity (MGD)
Groton Water Department[a]	SW	9.31	12.6
Norwich Water Department[a]	SW	5.2	7.16
New London Water Division[a]	SW	5.5	6.4
East Lyme Water and Sewer Commission[b]	GW	1.46	1.66
Waterford WPCA[b]	Purchases water from New London Water Division	N/A	N/A
CT – American Water Co. – Mystic Valley Division[a]	SW and GW	1.56	1.5
Colchester Sewer and Water Commission[c]	GW	0.48	0.74

a. Ref. 2.9-5.
b. Ref. 2.9-6.
c. Ref. 2.9-7.
GW – Groundwater
SW – Surface water
MGD – Million gallons per day
*Note: Grayed water systems currently exceed capacity.

Table 2-8.
Traffic Counts for Roads in the Vicinity of MPS.

	Roadway and Location	Annual Average Daily Traffic Volume[a,b]
1.	Highway 156 - Station Number 63 (just east of MPS entrance near Gardiners Wood Road)	9,600
2.	Highway 156 - Station Numbber 29 (west of Avery Road)	8,900
3.	Highway 156 - Station Number 33 (east of Avery Road)	12,800
4.	Highway 156 - Station Number 44 (west of intersection with U.S. 1)	14,700
5.	Highway 156 - Station Number 2190 (just west of MPS entrance and west of High Ridge Road)	10,400
6.	Highway 156 - Station Number 2032 (west of River Street)	10,200
7.	Highway 156 - Station Number 25 (east of Highway 161)	10,300
8.	Highway 156 - Station Number 26 (west of Highway 161)	10,600
9.	Highway 156 - Station Number 27 (east of East Pattagansett Road)	9,800
10.	Highway 156 - Station Number 18 (west of East Pattagansett Road)	9,600
11.	Highway 156 - Station Number 33 (east of Rocky Neck Connector)	8,900
12.	Highway 161 - Station Number 41 (northwest of Hope Street)	9,300
13.	Highway 161 - Station Number 15 (north of Sleepy Hollow Road)	9,900
14.	Highway 161 - Station Number 2010 (south of King Arthur Drive)	21,700
15.	Highway 161 - Station Number 8 (north of Boston Post Road)	11,900
16.	Highway 161 - Station Number 37 (north of Drabik Road)	6,700
17.	Highway 161 - Station Number 38 (south of Walnut Hill Road)	5,700
18.	U.S. 1 - Station Number 74 (east of Strosberg Road)	13,000
19.	U.S. 1 - Station Number 36 (west of Woodland Grove)	24,800
20.	U.S. 1 - Station Number 39 (southeast of Vivian Street)	25,200
21.	U.S. 1 - Station Number 35 (northwest of Vivian Street)	12,500
22.	U.S. 1 - Station Number 40 (northwest of Ellen Ward Road)	14,900
23.	U.S. 1 - Station Number 2051 (northwest of Cross Road)	9,900
24.	U.S. 1 - Station Number 5034 (west of Oswegatchie Road)	9,800

a. Ref. 2.9-8.
b Ref. 2.9-9.

Table 2-9.
Sites Listed in the National Register of Historic Places that fall within a 6-mile Radius of MPS.

Site Name	Location
Winslow Ames House	132 Mohegan Avenue., New London
Thomas Avery House	Society Road, East Lyme
Acors Barns House	68 Federal Street, New London
Bennett Rockshelter	Address Restricted, Old Lyme
Branford House	Shennecosset and Eastern Point Roads, Groton
Bulkeley School	Huntington Street, New London
Burnett's Corner Historic District	Packer Road, Groton
Civic Institutions Historic District	156-158, 171, 173-175 Garfield Avenue, 179 Colemen Street, 32 Wald Avenue, New London
Coit Street Historic District	Roughly bounded by Coit Street, Washington, Tilley, Bank, and Reed Streets, New London
Deshon-Allyn House	613 Williams Street, New London
Downtown New London Historic District	Roughly bounded by Captain's Walk, Bank, Tilley, and Washington Streets, New London
Downtown New London Historic District (Boundary Increase)	Along Huntington, Washington and Jay Streets; SW corner of Meridan and Governor Winthrop Boulevard; along Bank and Saryard Streets, New London
Eolia Harkness Estate	Great Neck Road, Waterford
Fort Griswold	Bounded by Baker Avenue, Smith Street, Park Avenue, Monument Avenue, and Thames River, Groton
Fort Trumbull	Fort Neck, New London
William Gorton Farm	14 West Lane, East Lyme
Florence Griswold House and Museum	96 Lyme Street, Old Lyme
Groton Bank Historic District	Roughly bounded by the Thames River, Broad, Cottage, and Latham Streets, Groton
Jonathan Newton Harris House	130 Broad Street, New London
Hempstead Street Historic District	Roughly bounded by Franklin Street, Jay Street, and Mountain Avenue, New London
Joshua Hempstead House	11 Hempstead Street, New London
Nathaniel Hempstead House	Corner of Jay, Hempstead, Coit, and Truman Streets, New London
Huntington Street Baptist Church	29 Huntington Street, New London

Table 2-9.
Sites Listed in the National Register of Historic Places that fall within a 6-mile Radius of MPS. (Cont.)

Site Name	Location
Jordan Village Historic District	Junction of North Road and Avery Lane with Rope Ferry Road, Waterford
Thomas Lee House	CT 156 and Giant's Neck Road, East Lyme
Lieutenant River III Site	Address Restricted, Old Lyme
Lieutenant River IV Site	Address Restricted, Old Lyme
Lieutenant River Number 2 Site	Address Restricted, Old Lyme
Lighthouse Inn	6 Guthrie Place, New London
Montauk Avenue Historic District	Roughly bounded by Ocean, Willets, and Riverview Avenues and Faire Harbor, New London
Monte Cristo Cottage	325 Pequot Avenue, New London
Natcon Site	Address Restricted, Old Lyme
New London County Courthouse	70 Hunting Street, New London
New London Customhouse	150 Bank Street, New London
New London Harbor Lighthouse	Lower Pequot Avenue, New London
New London Ledge Lighthouse	Entrance to New London Harbor, east side of Main Channel, New London
New London Public Library	63 Huntington Street, New London
New London Railroad Station	State Street, New London
Ohev Sholem Synagogue	109 Blinman Street, New London
Old Lyme Historic District	Lyme Street from Shore Road to Sill Lane, Old Boston Post Road from Sill Lane to Rose Lane, Old Lyme
Peck Tavern	1 Still Lane, Old Lyme
Pequot Fort	Address Restricted, Groton
Morton Freeman Plant Hunting Lodge	56 Stone Ranch Road, East Lyme
Post Hill Historic District	Roughly bounded by Broad, Center, Vauxhall, Berkeley, Freement, and Walker Streets, New London
Prospect Street Historic District	Roughly bounded by Bulkeley Place, Huntington, Federal, and Hempstead Streets, New London
Quaker Hill Historic District	Roughly along Old Norwich Road from Richards Grov Road to Mohegan Avenue Parkway, Waterford
Rocky Neck Pavilion	Lands End Point, Rocky Neck State Park, East Lyme

Table 2-9.
Sites Listed in the National Register of Historic Places that fall within a 6-mile Radius of MPS. (Cont.)

Site Name	Location
Shaw Mansion	11 Blinman Street, New London
Jabez Smith House	North Road, Groton
Samuel Smith House	82 Plants Dam Road, East Lyme
Springbank	69 Neck Road, Old Lyme
Thames Shipyard	Farnsworth Street, New London
The Seaside	36 Shore Road, Waterford
U.S.S. Nautilus (submarine)	Naval Submarine Base, Groton
United States Housing Corporation Historic District	Roughly bounded by Colman, Fuller, and West Pleasant Streets, and Jefferson Avenue, New London
U.S. Post Office, New London Main	27 Masonic Street, New London
Whale Oil Row	105-119 Huntington Street, New London
Williams Memorial Institute	110 Broad Street, New London
Williams Memorial Park Historic District	Roughly bounded by Hempstead and Broad Streets, Williams Memorial Parkway, and Mercer Street, New London
Winthrop Mill	Mill Street, New London
Nathan A. Woodworth House	28 Channing Street, New London
Edward Yeomans House	Brook Street, Groton

Sources: Ref. 2.11-2, Ref. 2.11-4.

Figure 2-1
50-Mile Vicinity Map

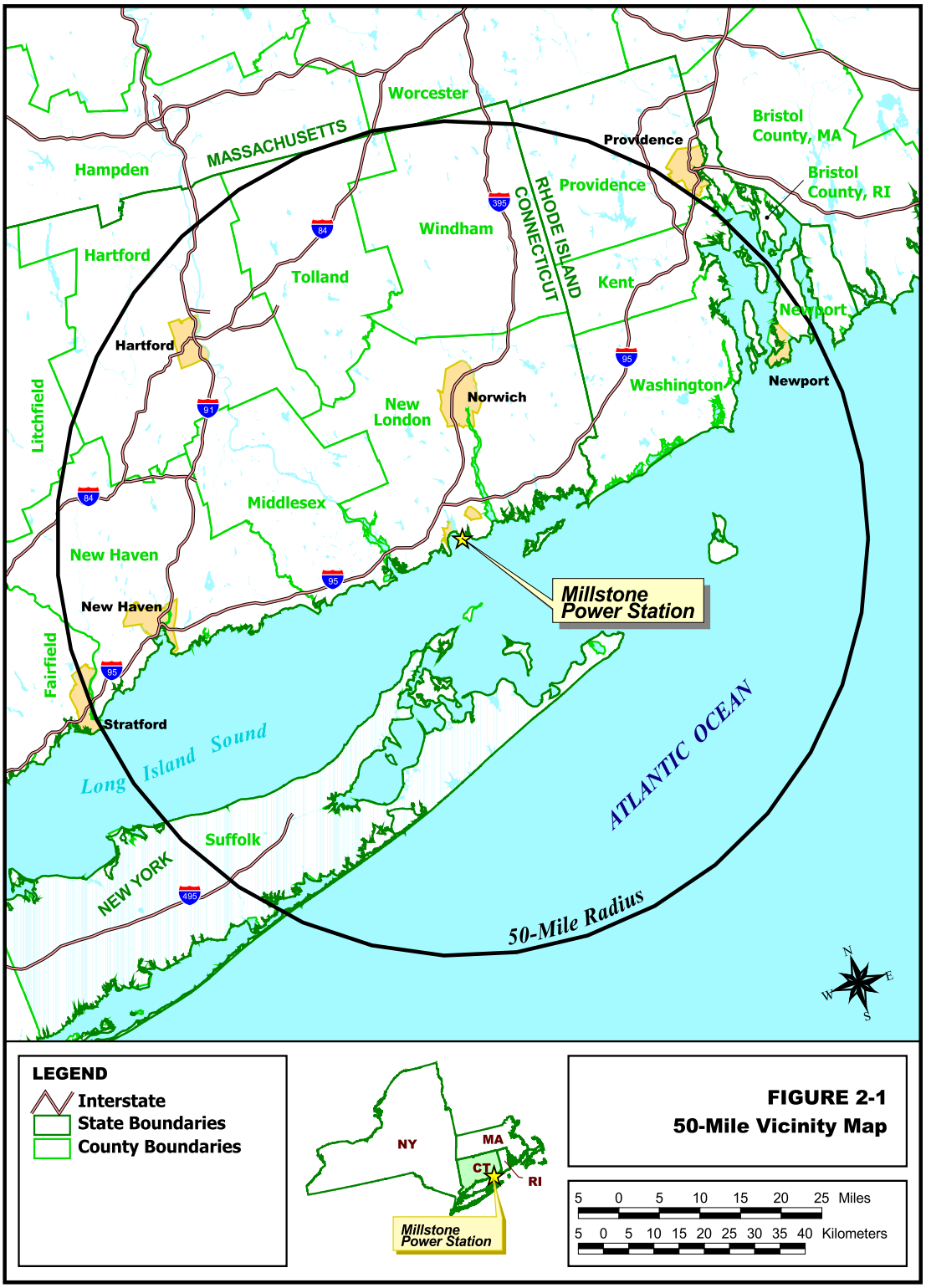


Figure 2-2
6-Mile Vicinity Map

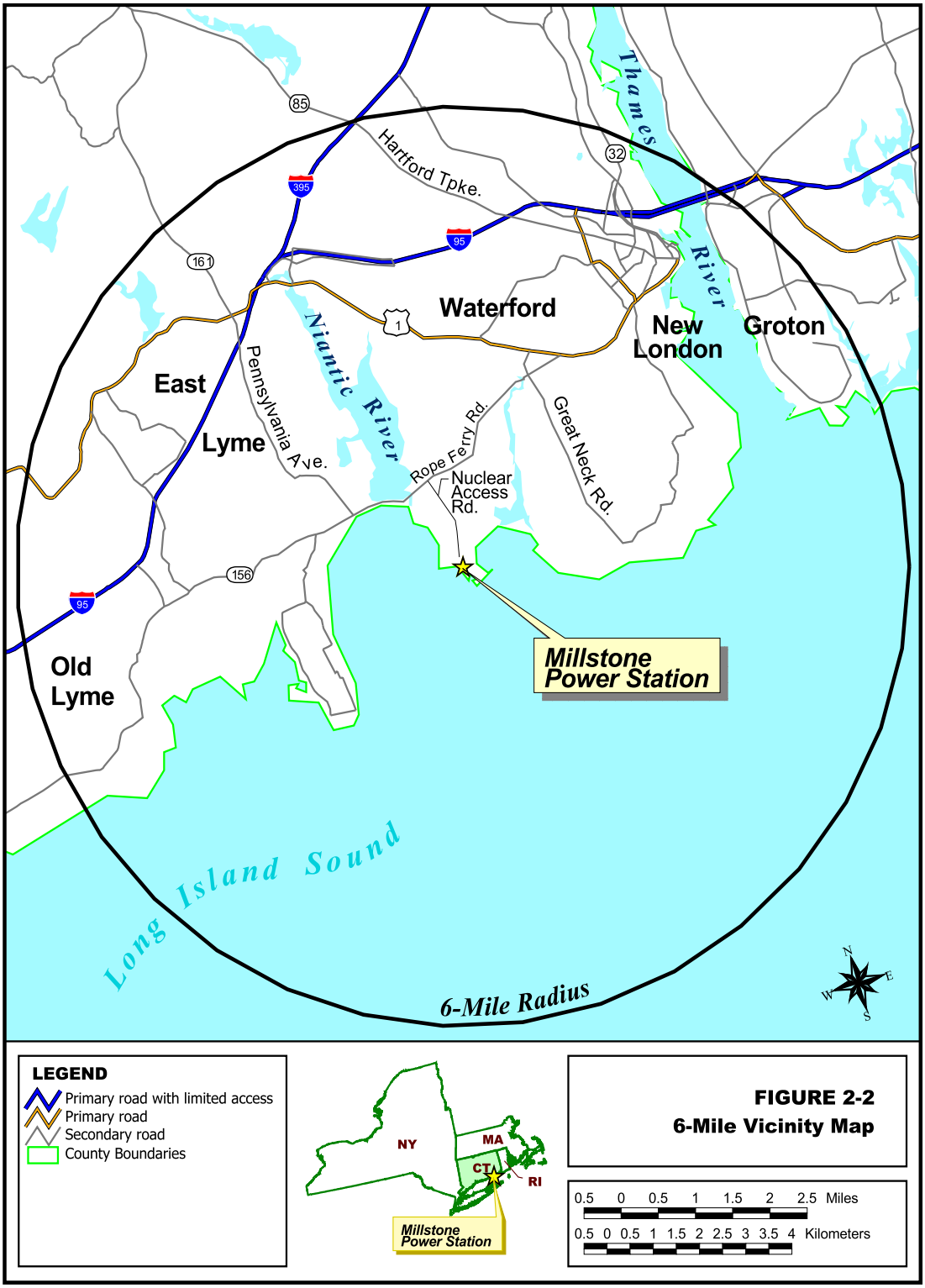


Figure 2-3
Millstone Power Station Site Boundary

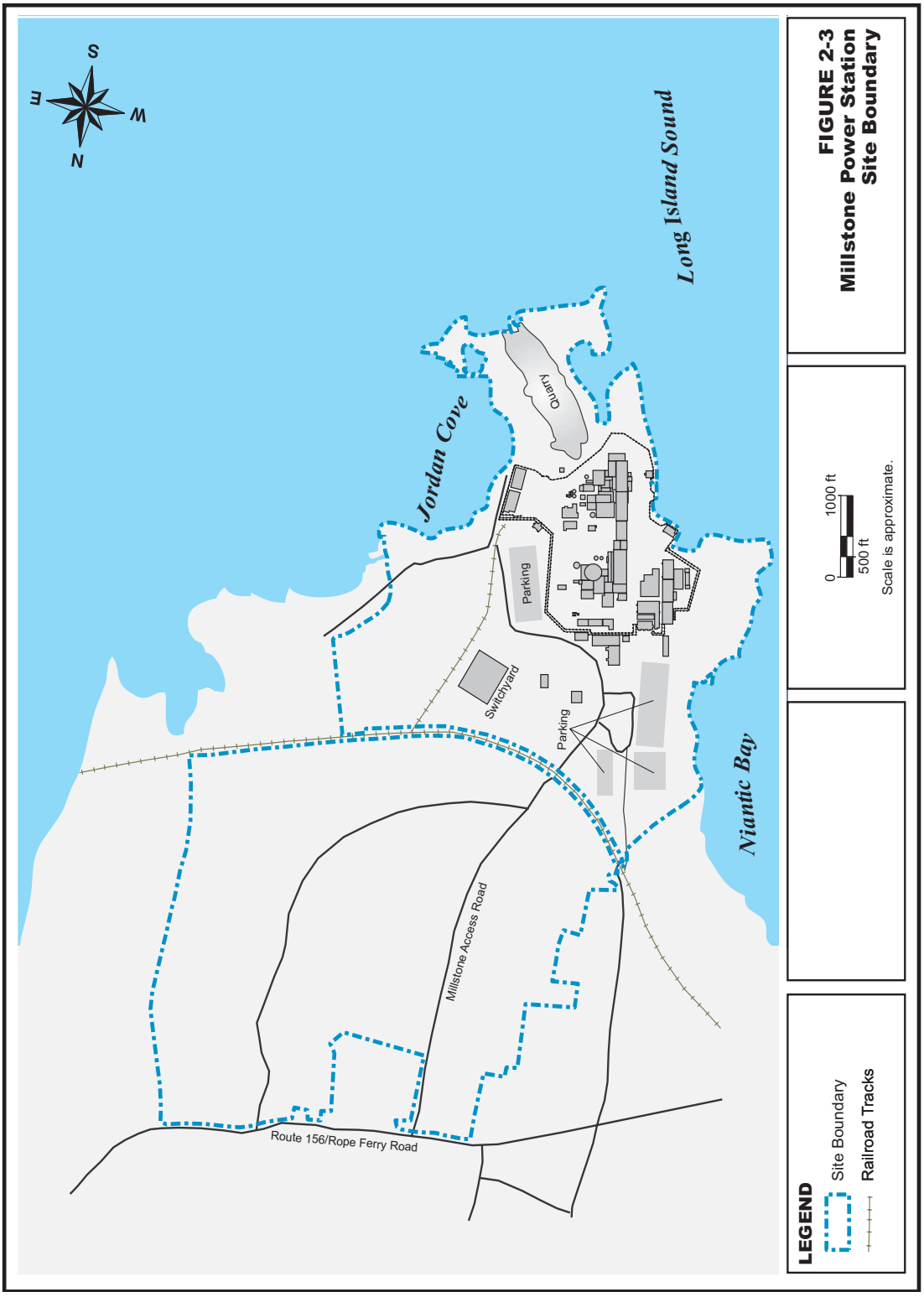


Figure 2-4
American Indian or Alaskan Native Minority Populations

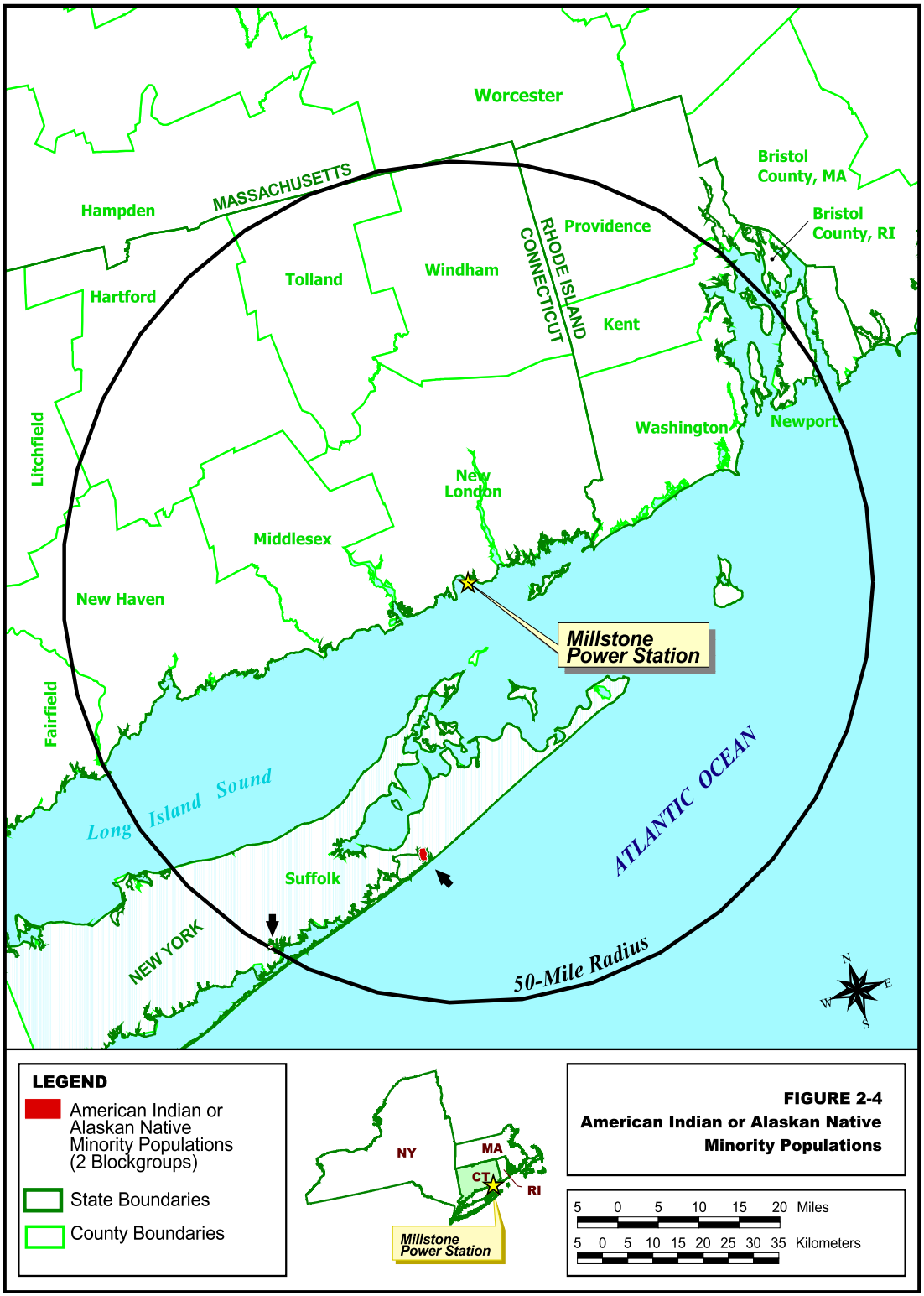


Figure 2-5
Asian Minority Populations

Figure 2-6
Black Minority Populations

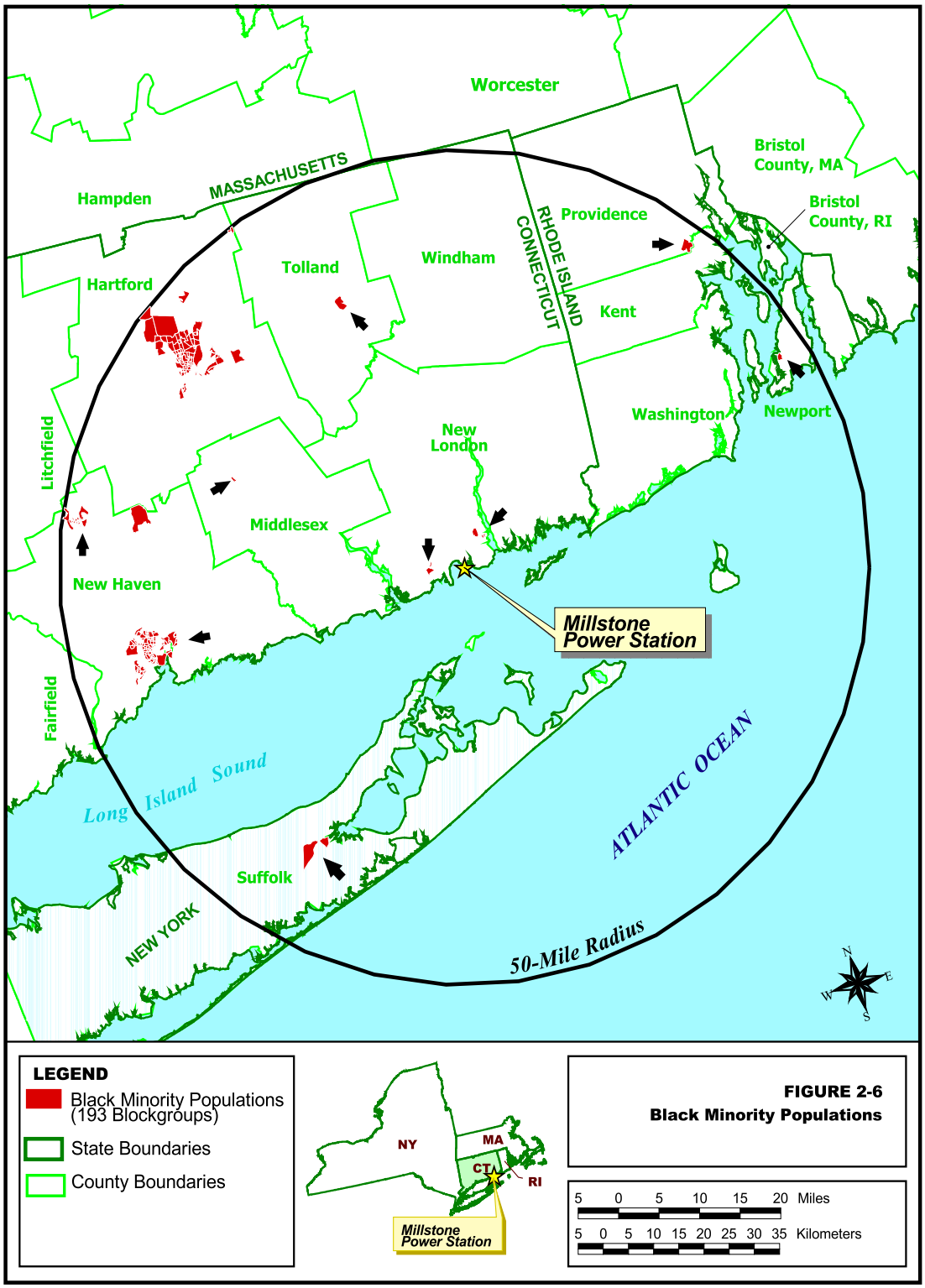


Figure 2-7
All Other Single Minority Populations

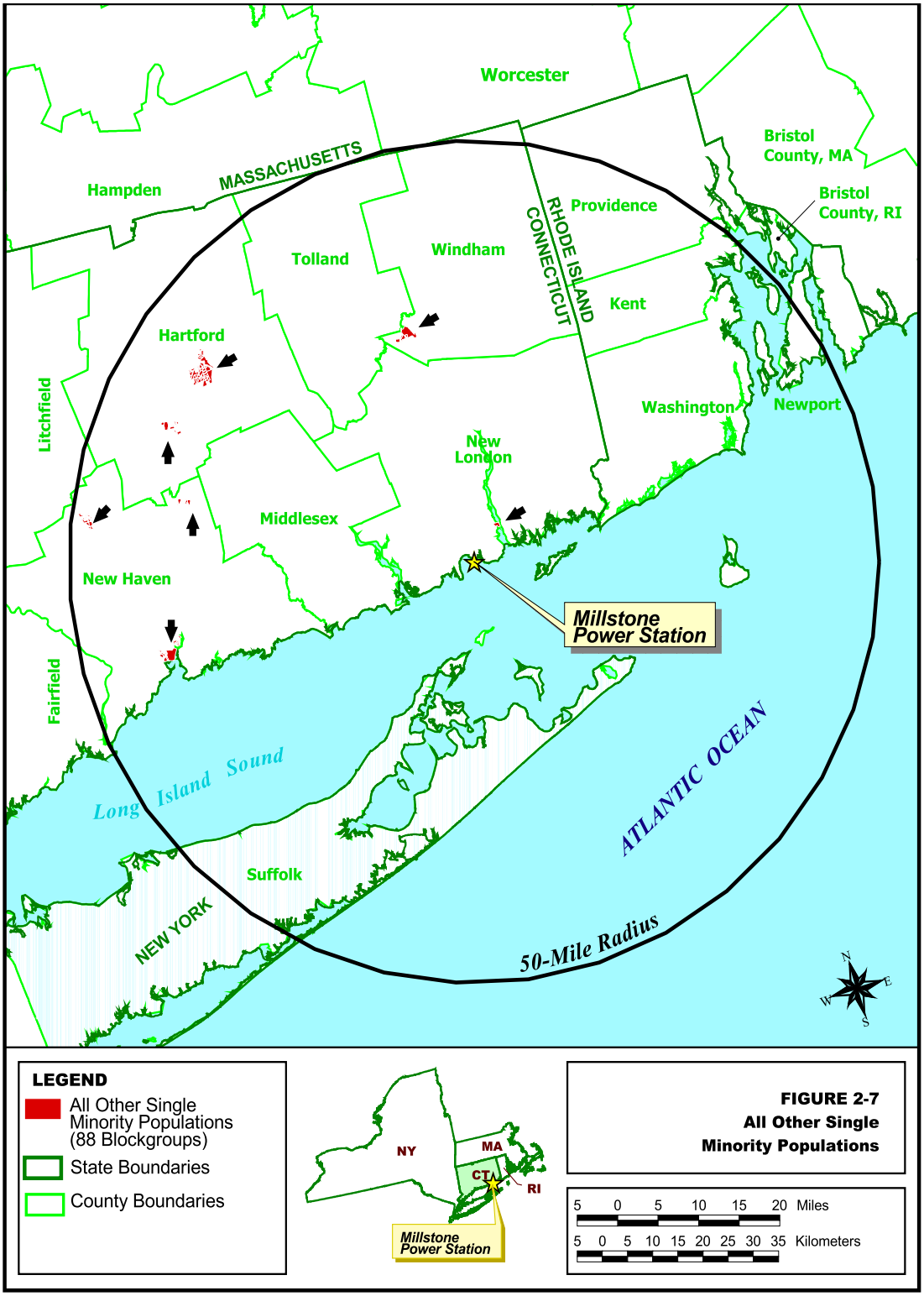


Figure 2-8
Aggregate Minority Populations

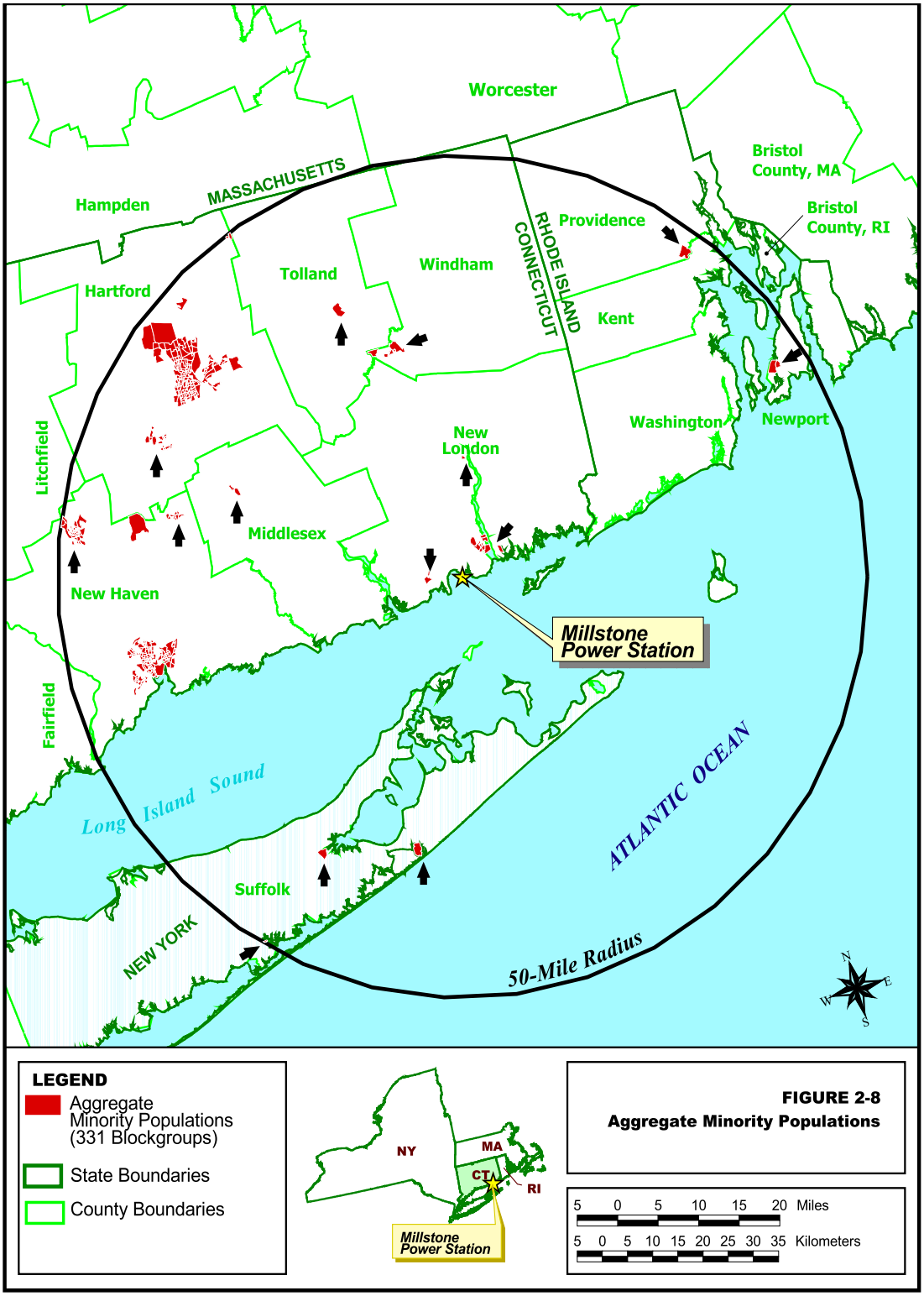


Figure 2-9
Hispanic Ethnicity Minority Populations

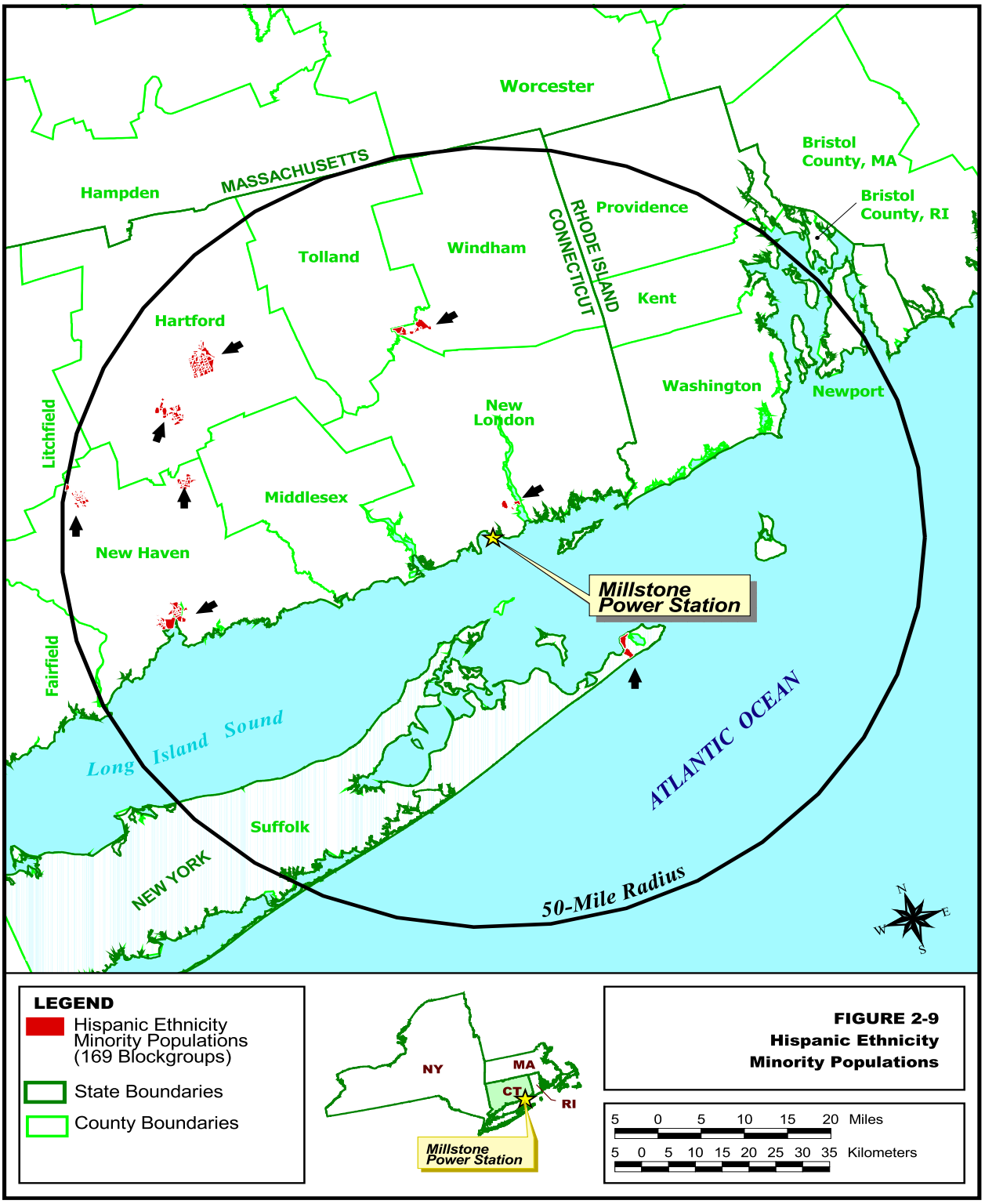


Figure 2-10
Low-Income Populations

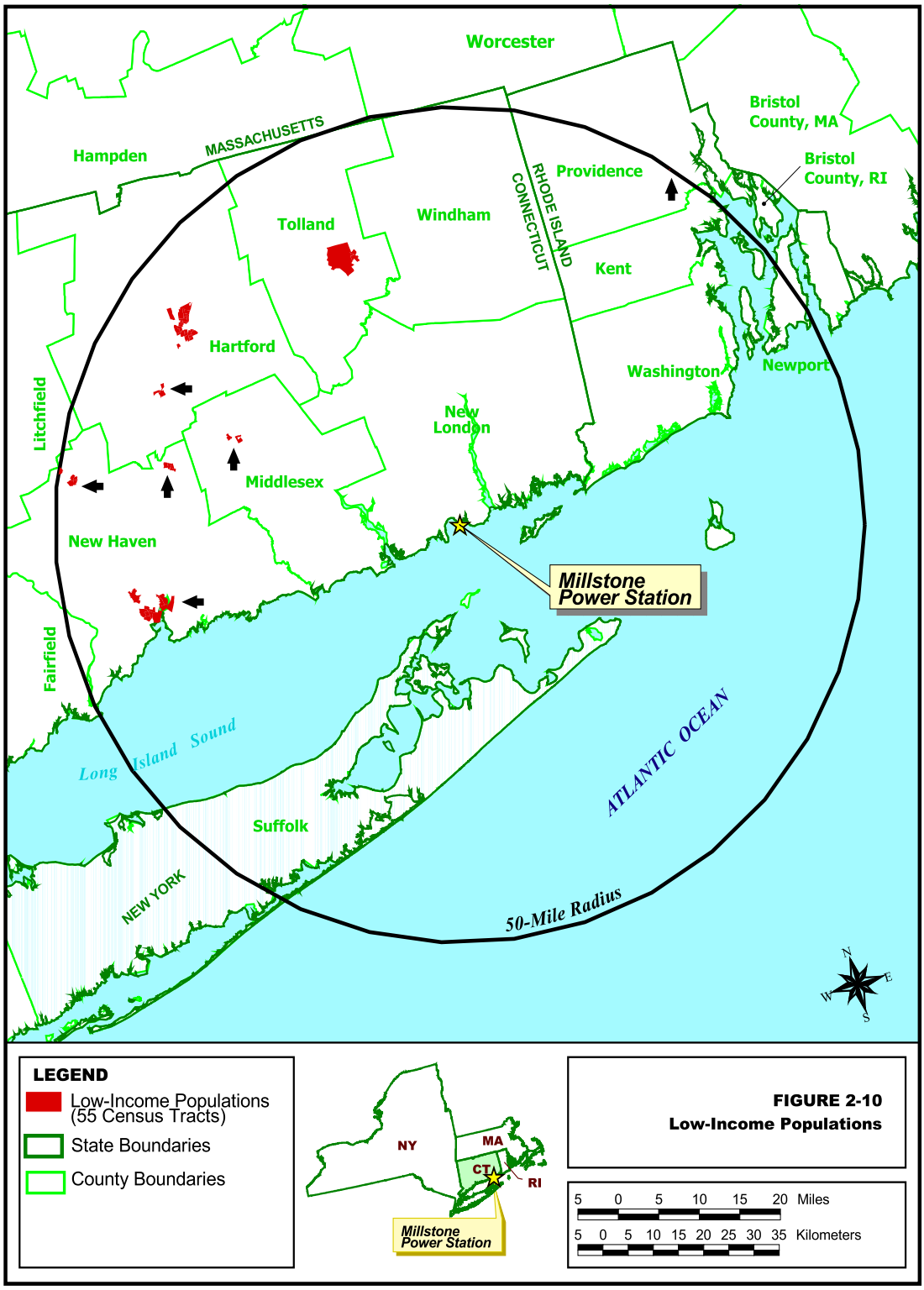
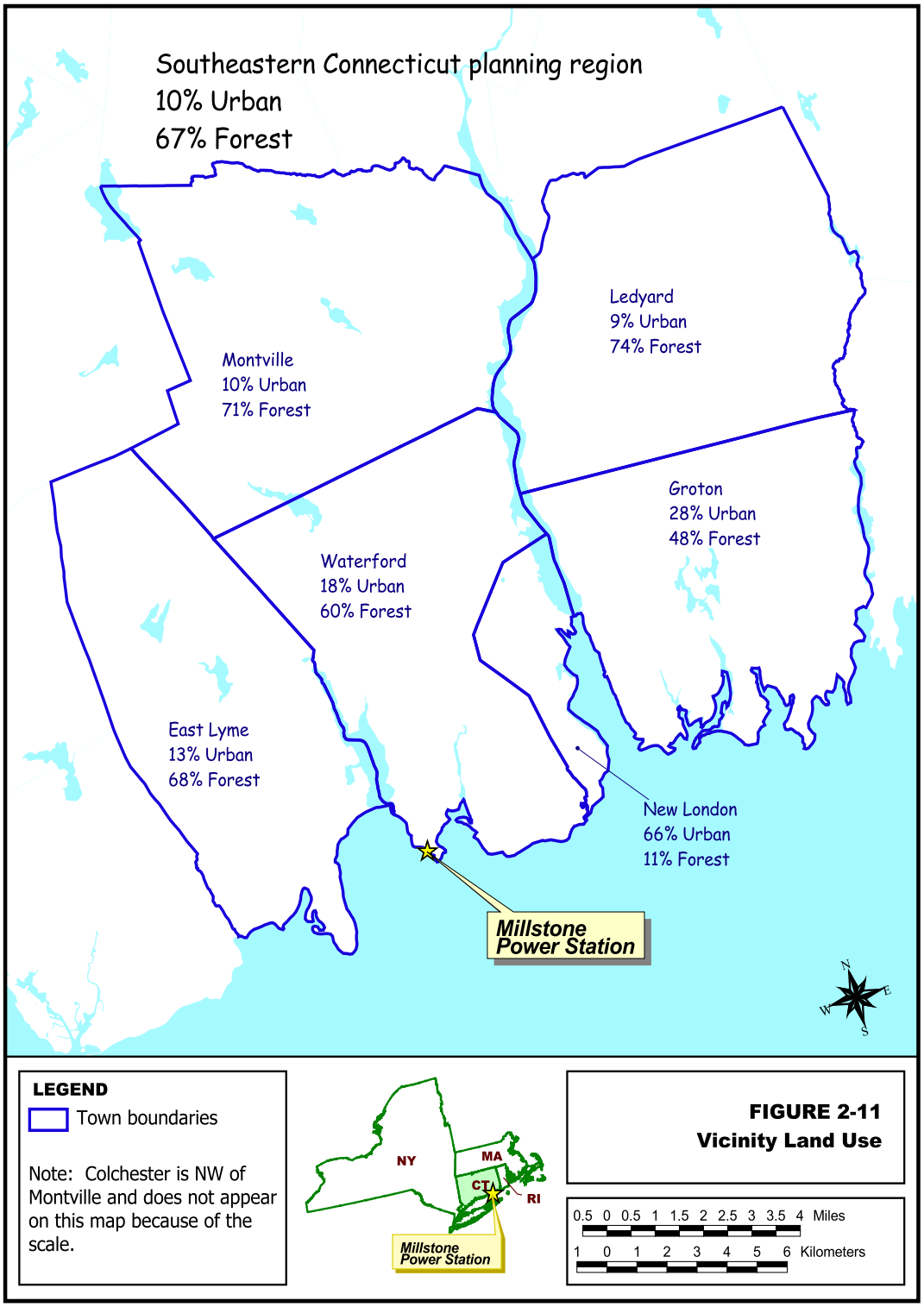


Figure 2-11
Vicinity Land Use



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Note to reader: Some web pages cited in this document are no longer available, or are no longer available through the original URL addresses. Hard copies of all cited web pa ges are available in DNC files. Some sites, for example the census data, cannot be accessed through their URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by DNC have been given for these pages, even though they may not be directly accessible.

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Ref. 2.11-4 Connecticut Historical Commission. Undated. “National Register of Historic Places – Connecticut Listings.” New London Counties. Available at http://www.chc.state.ct.us/NR-NEW%20LONDON.htm. Accessed March 13, 2002.

3.0 PROPOSED ACTION

NRC

"…The report must contain a description of the proposed action, including the applicant's plans to modify the facility or its administrative control procedures…. This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment…." 10 CFR 51.53(c)(2)

Dominion Nuclear Connecticut (DNC) proposes that the U.S. Nuclear Regulatory Commission (NRC) renew the operating licenses for Millstone Power Station Units 2 and 3 (MPS) for an additional 20 years. Renewal would maintain the option of relying on MPS to meet future electricity needs. Section 3.1 discusses the plant in general. Sections 3.2 through 3.4 address potential changes that could occur as a result of license renewal.

3.1 General Plant Information

General information about MPS is available in several documents. In 1973, the U.S. Atomic Energy Commission, the predecessor agency of NRC, prepared the Final Environmental Statement for operation of MPS Unit 2 (Ref 3.1-1), and in 1984 the NRC prepared the Final Environmental Statement for the operation of MPS Unit 3 (Ref 3.1-2). The NRC Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (Ref 3.1-3) describes MPS features and, in accordance with NRC requirements, DNC maintains the Updated Final Safety Analysis Reports for MPS Units 2 and 3 (Ref 3.1-4, Ref 3.1-5). DNC has referred to each of these documents while preparing this environmental report for license renewal.

3.1.1 Reactor and Containment Systems

3.1.1.1 Unit 2

MPS Unit 2 is a two-loop closed-cycle pressurized water nuclear reactor furnished by Combustion Engineering, Inc. with a turbine-generator furnished by General Electric Company. The remainder of the unit was designed and constructed with engineering support from Bechtel. The reactor is housed in double containment consisting of a steel-lined, prestressed concrete cylindrical structure enclosed by the enclosure building.

MPS Unit 2 fuel is slightly enriched (less than 5 weight percent) uranium dioxide with an average burnup for the peak rod of 62,000 megawatt days per metric ton uranium.

MPS Unit 2 has a licensed thermal output of 2,700 MWt which results in a net calculated electrical output of approximately 870 MWe (Ref 3.1-3).

Engineered Safety Features (ESF) are provided to mitigate the consequences of postulated accidents, including loss-of-cooling accidents. Engineered safety features provide protection to the public and plant personnel against the release of radioactive products from the reactor system, particularly as the result of a loss-of-cooling accident. ESF localize, control, mitigate, and terminate such accidents to hold exposure levels below the applicable limits of 10 CFR 100. Figure 3-1 shows the plant layout.

3.1.1.2 Unit 3

MPS Unit 3 is a four-loop, closed cycle, pressurized water nuclear reactor steam supply system furnished by Westinghouse Electric Corporation with a turbine-generator furnished by General Electric Company. The remainder of the

unit was designed and constructed with architect-engineering support provided by Stone and Webster Engineering Corporation. The reactor is in a steel-lined, reinforced concrete subatmospheric containment structure.

MPS Unit 3 fuel is slightly enriched to less than 5.0 weight percent uranium-235 with an average burnup for the peak rod of approximately 60,000 megawatt days per metric ton uranium.

MPS Unit 3 has a licensed thermal output of 3,411 MWt which results in a net calculated electrical output of approximately 1,154 MWe (Ref 3.1-3).

ESF are provided to mitigate the consequences of postulated accidents, including loss-of-cooling accidents. ESF provide protection to the public and plant personnel against the release of radioactive products from the reactor system, particularly as the result of a loss-of-cooling accident. The ESF localize, control, mitigate, and terminate such accidents to hold exposure levels below the applicable limits of 10 CFR 100. Figure 3-1 shows the plant layout.

3.1.2 Cooling and Auxiliary Water Systems

MPS uses a once-through cooling water system with intakes on Niantic Bay (a part of Long Island Sound), and surface discharges to the old quarry. Water from the quarry flows back into Long Island Sound. Figure 3-1 shows the locations of the intake and discharge structures.

3.1.2.1 Unit 2

The Unit 2 intake structure has four circulating water pumps, each with a maximum pump rate of 137,200 gallons per minute (gpm) to pump cooling water through the condensers. Maximum flow through the condensers is 548,800 gpm.

Trash racks and 3/8-inch mesh traveling screens prevent debris and large organisms from entering the circulating water system. Organisms removed from the screens are returned to the bay via a fish return sluiceway installed in 2000. Post-installation studies indicate that the sluiceway system results in survival rates in excess of 90 percent for winter flounder and lobsters entering the intake structure. In addition, a cutoff wall in front of the intake extends 9 feet below the surface to prevent surface water and organisms from entering the intake. Water velocity in front of the intake structure is estimated to be about 0.6 feet per second. The system has a sodium hypochlorite system that injects the chemical on a periodic basis, for 30 minutes per intake bay between the trash racks and traveling screens and is designed to maintain a 0.2 parts per million (ppm)

chlorine concentration. Thermal backwashing is also performed to prevent mussels from fouling the intake structure pump bays.

At full flow, water temperature increases approximately 23-26°F as it crosses the condensers.

Unit 2 also has three service water pumps rated at 12,000 gpm each, that withdraw water downstream of the traveling screens. Two pumps are normally operating. The service water system has a sodium hypochlorite injection system that continuously injects the chemical directly into the service water system to prevent biofouling. Chlorine concentration is limited by the NPDES permit. Service water is returned to the cooling water discharge system prior to the discharge entering the quarry.

3.1.2.2 **Unit 3**

The Unit 3 intake structure has six bays, each with a circulating water pump with a flow of approximately 152,000 gpm. Total flow through the condensers is approximately 912,000 gpm. Each bay contains a trash rack and 3/8-inch mesh traveling screens. Individual trash and fish troughs collect and sluice debris and fish from the screens. Trash is moved on a conveyor to a trash container for disposal in a landfill. Fish are directed from the fish trough to a sluice way which returns them to Niantic Bay. Although the Unit 3 intake was originally constructed with a sluiceway, a new and more effective sluiceway system was installed in 1990-92, resulting in a return rate of organisms greater than 95 percent, and a survival rate in excess of 80-90 percent for many species, including winter flounder and lobsters. Chemical additions and thermal backwash prevent biofouling as described for Unit 2.

At full flow, water temperature increases approximately 17-18°F as it crosses the condensers.

Unit 3 also has four service water pumps with a capacity of 15,000 gpm each. Two pumps are normally operating. Chlorine injection is as described for Unit 2. Service water is returned to the cooling water discharge system prior to the discharge entering the quarry.

3.1.2.3 **Discharge**

Water from the circulating and service water systems (and other water systems) is discharged into each unit's discharge tunnel prior to the surface release into the quarry. Water flows down the quarry and through the two "Quarry Cuts" into Long Island Sound. The National Pollutant Discharge Elimination System (NPDES)

permit for MPS limits the discharge temperatures to 105°F, and the maximum increases in temperature at the Quarry Cut to 32°F above intake temperatures at full flow. The discharge is not allowed to increase the temperature of Long Island Sound beyond the 8,000-foot-radius mixing zone by more than an average of 4°F or above 83°F (Ref 3.1-6, 9).

3.1.2.4 **Potable, Sanitary and Process Water**

Potable, sanitary and process (other than cooling) water comes from the town of New London. Estimated use is approximately 332,000 gallons per day. In the past, MPS withdrew groundwater from several wells on site for sanitary purposes, but no longer does so. However, registrations for these wells are maintained, even though DNC has no plans to reinstate groundwater withdrawals.

3.1.3 **Transmission Facilities**

As described in the Final Environmental Statements for Unit 3, [Construction Permit Stage (Ref 3.1-7, 3-30) and Operation (Ref 3.1-2, 4-9)] and the environmental report for Unit 2 (Ref 3.1-8, 3.6-1), four 345-kilovolt transmission lines have been built to connect Millstone to the electric grid. The Millstone-to-Manchester line was constructed on existing rights-of-way to add Millstone Unit 3 to the southern New England transmission grid. A section of the Millstone-to-Southington line was constructed on existing rights-of-way to add Unit 2 to the transmission grid. The remainder of that line was strung on existing poles in the Millstone-to-Hunts Brook Junction corridor. The Millstone-to-Card Street Substation and Millstone-to-Montville Station lines were constructed for Unit 1. These four transmission lines run northward from the plant in a common corridor (415 to 500 feet wide) for 9.1 miles to Hunts Brook Junction. At Hunts Brook Junction, the lines diverge with two lines running north to the Card and Manchester Substations, one line running east to the Montville Station, and one line running west to the Southington Substation. These four lines share corridors with other previously existing transmission lines unrelated to MPS. Therefore, these corridors must be maintained irrespective of MPS operation.

The owner of these transmission lines is Connecticut Light and Power, a subsidiary of Northeast Utilities. These four lines are briefly described as follows. Figure 3-2 is a map of the transmission system of interest.

- Millstone – Montville Station (Line 371) – From the Hunts Brook Junction, this line runs eastward for 3.7 miles to the Montville Station in a 325-foot corridor. The total length is 12.8 miles.

- Millstone – Card Street Substation (Line 383) – From the Hunts Brook Junction, Line 383 runs north for 19.8 miles to the Card Substation, sharing the corridor with the Manchester line most of the way. The total length of this line is 28.9 miles and the corridor averages 300 feet wide.
- Millstone – Manchester Substation (Line 310) – The Manchester line is the newest of the four Millstone lines, having been built for Unit 3. It runs a total of 47.1 miles in a corridor ranging from 250 to 365 feet wide (300 feet average).
- Millstone – Southington (Line 348) – Southington is the longest of the Millstone transmission lines at 53.3 miles and was constructed for Unit 2. It runs west from Hunts Brook Junction for 44.2 miles in a corridor averaging 250 feet wide.

In total, Connecticut Light and Power has approximately 91 miles of corridor or approximately 3,052 acres of pre-existing corridor which were used to connect Millstone Units 2 and 3 to the transmission system. The corridors pass through land that is primarily agricultural and forest land. The areas are mostly remote, with low population densities. The longer lines cross numerous state and U.S. highways; all cross I-95 approximately 4 miles after leaving the plant switchyard. Corridors that pass through farmlands generally continue to be used as farmland. Connecticut Light and Power plans to maintain these transmission lines, which are integral to the larger transmission system, indefinitely. All four transmission lines associated with the station will remain a permanent part of the transmission system after Millstone is decommissioned.

The transmission lines were designed and constructed in accordance with the National Electrical Safety Code (for example, Ref 3.1-9) and industry guidance that was current when the lines were built. Ongoing right-of-way surveillance and maintenance of Millstone transmission facilities ensure continued conformance to design standards. These maintenance practices are described in Sections 2.4 and 4.13.

3.2 Refurbishment Activities

NRC

"… The report must contain a description of … the applicant's plans to modify the facility or its administrative control procedures…. This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment…." 10 CFR 51.53(c)(2)

"… The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40-year license term will be from one of two broad categories: ... and (2) major refurbishment or replacement actions, which usually occur fairly infrequently and possibly only once in the life of the plant for any given item…." (Ref. 3.1-3, Section 2.6.3.1)

DNC has addressed refurbishment activities in this environmental report in accordance with NRC regulations and complementary information in the NRC GEIS for license renewal (Ref 3.1-3). NRC requirements for the renewal of operating licenses for nuclear power plants include the preparation of an integrated plant assessment (IPA) (10 CFR 54.21). The IPA must identify and list systems, structures, and components subject to an aging management review. Items that are subject to aging and might require refurbishment include, for example, the reactor vessel, piping, supports, and pump casings (see 10 CFR 54.21 for details), as well as those that are not subject to periodic replacement.

In turn, NRC regulations for implementing the National Environmental Policy Act require environmental reports to describe in detail and assess the environmental impacts of refurbishment activities such as planned modifications to systems, structures, and components or plant effluents [10 CFR 51.53(c)(2)]. Resource categories to be evaluated for impacts of refurbishment include terrestrial resources, threatened and endangered species, air quality, housing, public utilities and water supply, education, land use, transportation, and historic and archaeological resources.

The GEIS (Ref 3.1-3) provides helpful information on the scope and preparation of refurbishment activities to be evaluated in this environmental report. It describes major refurbishment activities that utilities might perform for license renewal that would necessitate changing administrative control procedures and modifying the facility. The GEIS analysis assumes that an applicant would begin any major refurbishment work shortly after NRC grants a renewed license and would complete the activities during five outages, including one major outage at the end of the 40th year of operation. The GEIS refers to this as the refurbishment period.

GEIS Table B.2 lists license renewal refurbishment activities that NRC anticipated utilities might undertake. In identifying these activities, the GEIS intended to encompass actions that typically take place only once, if at all, in the life of a nuclear plant. The GEIS analysis assumed that a utility would undertake these activities solely for the purpose of extending

plant operations beyond 40 years, and would undertake them during the refurbishment period. The GEIS indicates that many plants will have undertaken various refurbishment activities to support the current license period, but that some plants might undertake such tasks only to support extended plant operations.

The MPS IPA that DNC conducted under 10 CFR 54 has not identified the need to undertake any major refurbishment or replacement actions to maintain the functionality of important systems, structures, and components during the MPS license renewal period. DNC has included the IPA as part of this application.

3.3 Programs and Activities for Managing the Effects of Aging

NRC

"…The report must contain a description of … the applicant's plans to modify the facility or its administrative control procedures…. This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment…." 10 CFR 51.53(c)(2)

"…The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40-year license term will be from one of two broad categories: (1) SMITTR actions, most of which are repeated at regular intervals …." (Ref. 3.1-3) (SMITTR is defined in Ref. 3.1-3 as surveillance, monitoring, inspections, testing, trending, and recordkeeping.)

The IPA required by 10 CFR 54.21 identifies the programs and inspections for managing aging effects at MPS. These programs are described in Appendix B, Aging Management Programs, of the Millstone Power Station, Unit 2 and Unit 3 License Renewal Applications.

3.4 Employment

Current Workforce

DNC employs a total nuclear-related workforce of approximately 1,550-1,650 employees and long-term contractors at MPS. Operational activities generally require 600 to 800 personnel per reactor unit (Ref 3.1-3, Section 2.3.8.1). Approximately 85 percent of MPS's employees live in New London or Middlesex Counties. Another 14 percent are distributed across 14 counties in Connecticut, Massachusetts, and Rhode Island with numbers ranging from 1 to 60 employees per county. Less than 1 percent of the workforce resides outside of these three states.

The MPS reactors are on an 18-month refueling cycle. During refueling outages, site employment increases above the 1,550-1,650 workforce by as many as 700-800 workers for temporary (28-30 days) duty. These numbers are within the GEIS range of 200 to 900 additional workers per reactor outage.

License Renewal Increment

Performing the license renewal activities would necessitate increasing MPS staff workload by some increment. The size of this increment would be a function of the schedule within which DNC must accomplish the work and the amount of work involved. Having determined that it would not undertake refurbishment (Section 3.2), DNC focused its analysis of license renewal employment increment on programs and activities for managing the effects of aging (Section 3.3).

The GEIS (Ref 3.1-3, Section 2.6.2.7) assumes that NRC would renew a nuclear power plant license for a 20-year period, beyond the duration remaining on the current license, and that NRC would issue the renewal approximately 10 years prior to license expiration. The GEIS further assumes that the utility would initiate SMITTR activities after issuance of the new license and would conduct license renewal SMITTR activities throughout the remaining 30-year life of the plant, sometimes during full-power operation (Ref 3.1-3, Section B.3.1.3), but mostly during normal refueling and the 5- and 10-year in-service refueling outages (Ref 3.1-3, Table B.4).

MPS has determined that the GEIS scheduling assumptions are reasonably representative of MPS incremental license renewal workload scheduling. Many MPS license renewal SMITTR activities would have to be performed during outages. Although some MPS license renewal SMITTR activities would be one-time efforts, others would be recurring periodic activities that would continue for the life of the Station.

The GEIS estimates that the most additional personnel needed to perform license renewal SMITTR activities would typically be 60 persons during the 3-month duration of a 10-year in-service refueling. Having established this upper value for what would be a single event in

20 years, the GEIS uses this number as the expected number of additional permanent workers needed per unit attributable to license renewal. NRC uses this approach in order to "…provide a realistic upper bound to potential population-driven impacts…." (Ref 3.1-3, Section 4.7)

The aging management programs identified in DNC's IPA are generally continuations of existing programs that can be implemented without significant additional staffing. DNC expects that existing "surge" capabilities for routine activities will enable DNC to perform the majority of the increased SMITTR workload with existing staff. It is estimated that, at most, 1 to 5 additional employees may be needed. Therefore, DNC has no plans to add more than 1 to 5 non-outage employees to support MPS operations during the license renewal term. Refueling and maintenance outages typically have durations of approximately 30 days and, as described above, result in a large, temporary increase in employment at MPS. DNC believes that the majority of increased SMITTR tasks can be performed with the schedule and level of employment. Therefore, DNC has no plans to add outage employees for license renewal term outages.

Figure 3-1
Miillstone Power Station Site Layout

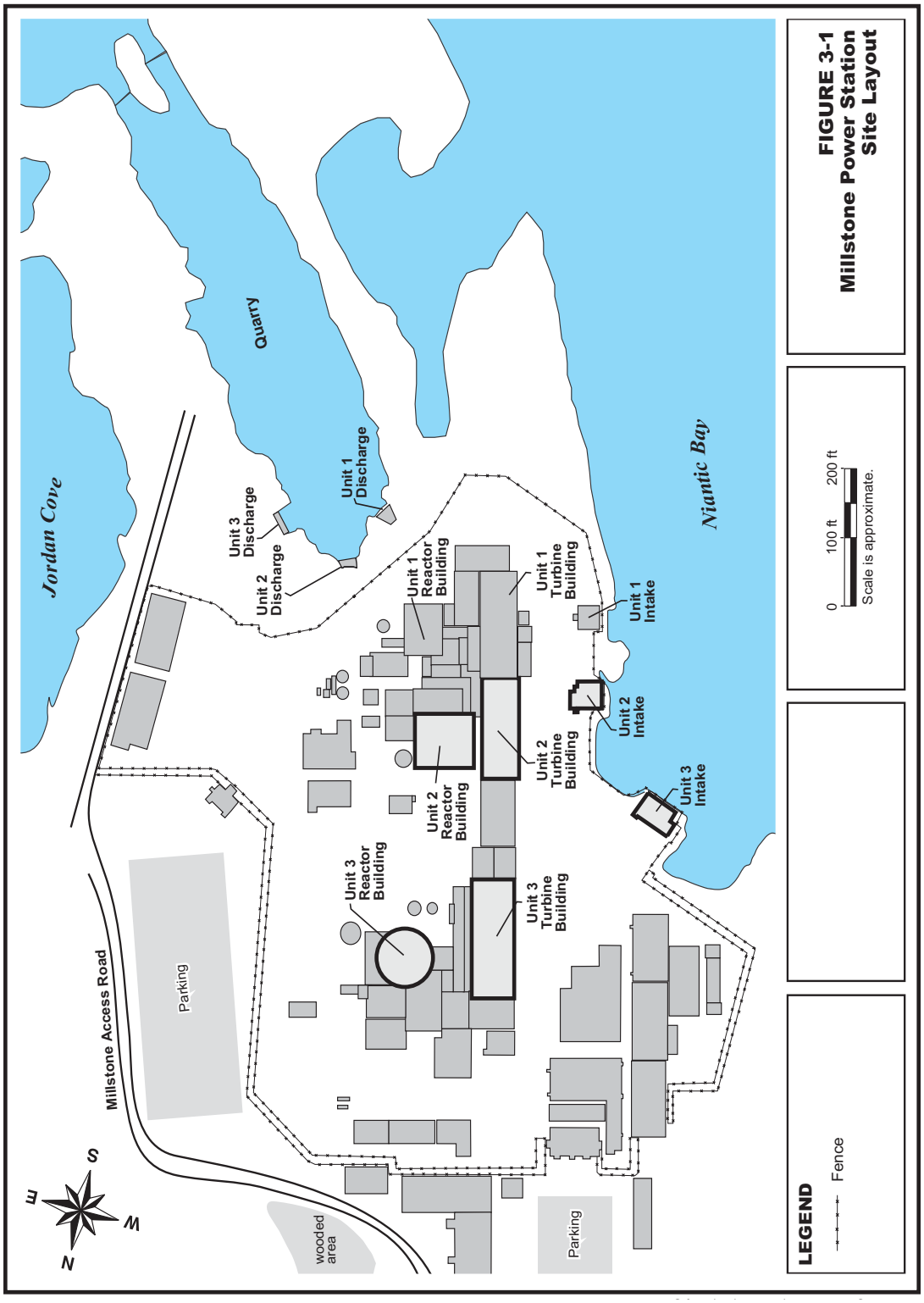
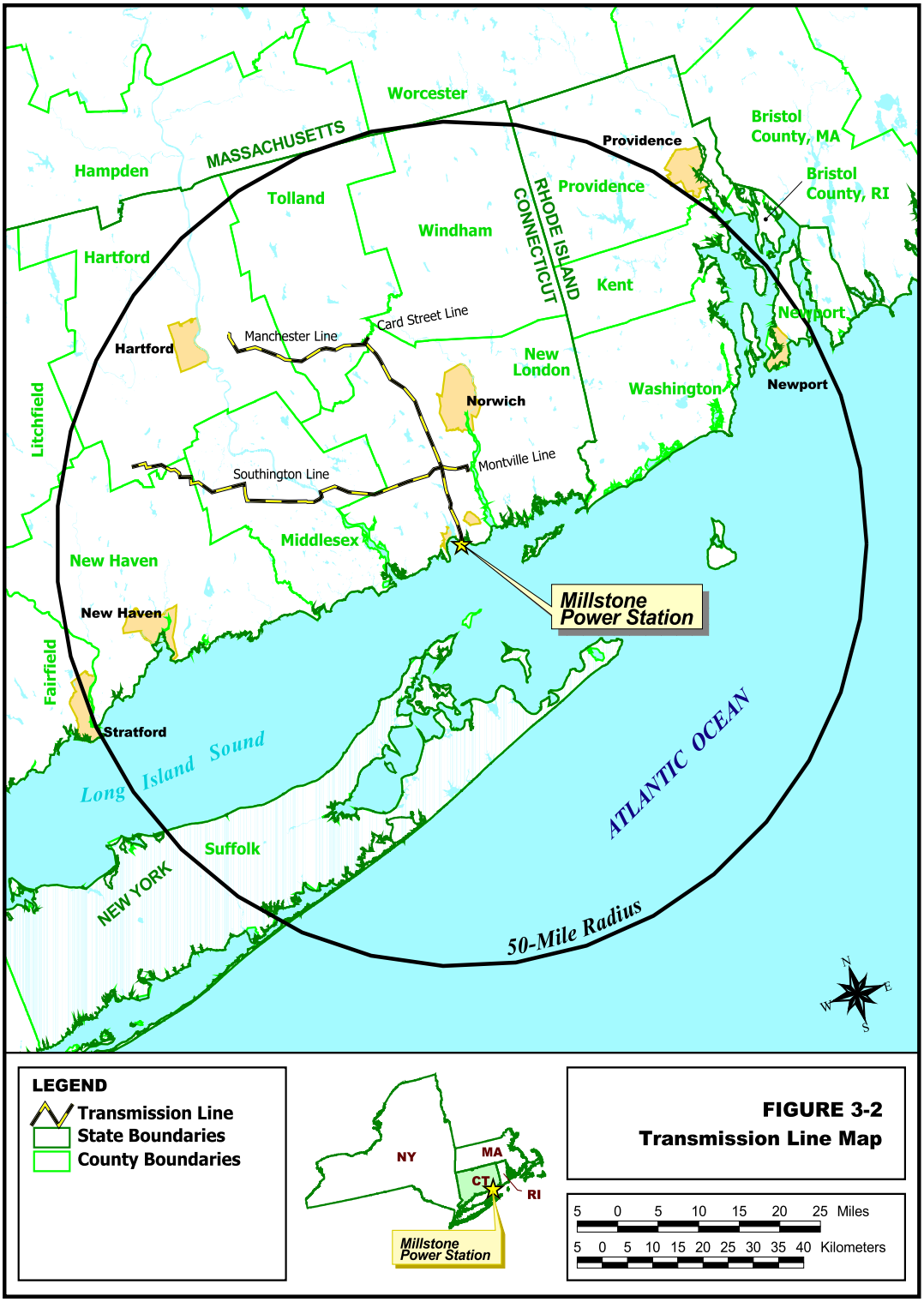


Figure 3-2
Transmission Line Map



3.5 References

Ref. 3.1-1 U.S. Atomic Energy Commission. 1973. Final Environmental Statement Related to the Continuation of Construction of Unit 2 and the Operation of Units 1 and 2 Millstone Nuclear Power Station. Directorate of Licensing. June.

Ref. 3.1-2 U.S. Nuclear Regulatory Commission. 1984. Final Environmental Statement Related to the Operation of Millstone Nuclear Power Station, Unit No. 3. NUREG-1064. Office of Nuclear Reactor Regulation. December.

Ref. 3.1-3 U.S. Nuclear Regulatory Commission. 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants. Volumes 1 and 2. NUREG-1437. Washington, DC. May.

Ref. 3.1-4 Dominion Nuclear Connecticut, Inc. Undated a. Final Safety Analysis Report. Unit 2. Rev. 21. Waterford, Ct.

Ref. 3.1-5 Dominion Nuclear Connecticut, Inc. Undated b. Final Safety Analysis Report. Unit 3. Rev. 16. Waterford, Ct.

Ref. 3.1-6 Connecticut Department of Environmental Protection. 1992. NPDES permit CT 0003263.

Ref. 3.1-7 U.S. Atomic Energy Commission. 1974. Final Environmental Statement Related to the Construction of Millstone Nuclear Power Station Unit 3. Directorate of Licensing. February.

Ref. 3.1-8 Northeast Utilities Service Company. Undated. Millstone Nuclear Power Station Unit 2. Environmental Report – Operating License Stage.

Ref. 3.1-9 America National Standards Institute. 1997. National Electrical Safety Code, ANSI C2-1997, Institute of Electrical and Electronics Engineers, Inc., New York, New York.

4.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND MITIGATING ACTIONS

NRC

"The report must contain a consideration of alternatives for reducing impacts…for all Category 2 license renewal issues…." 10 CFR 51.53(c)(3)(iii)

"The environmental report shall include an analysis that considers…the environmental effects of the proposed action…and alternatives available for reducing or avoiding adverse environmental effects." 10 CFR 51.45(c) as adopted by 10 CFR 51.53(c)(2)

The environmental report shall discuss the "…impact of the proposed action on the environment. Impacts shall be discussed in proportion to their significance…." 10 CFR 51.45(b)(1) as adopted by 10 CFR 51.53(c)(2)

"The information submitted…should not be confined to information supporting the proposed action but should also include adverse information." 10 CFR 51.45(e) as adopted by 10 CFR 51.53(c)(2)

Chapter 4.0 presents an assessment of the environmental consequences and potential mitigating actions associated with the renewal of the Millstone Power Station (MPS) operating license. The U.S. Nuclear Regulatory Commission (NRC) has identified and analyzed 92 environmental issues that it considers to be associated with nuclear power plant license renewal and has designated the issues as Category 1, Category 2, or NA (not applicable). NRC designated an issue as Category 1 if, based on the result of its analysis, the following criteria were met:

- the environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic;
- a single significance level (i.e., small, moderate, or large) has been assigned to the impacts that would occur at any plant, regardless of which plant is being evaluated (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent-fuel disposal); and
- mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely to be not sufficiently beneficial to warrant implementation.

If the NRC analysis concluded that one or more of the Category 1 criteria could not be met, NRC designated the issue as Category 2. NRC requires plant-specific analyses for Category 2 issues.

Finally, NRC designated two issues as NA, signifying that the categorization and impact definitions do not apply to these issues.

NRC rules do not require analyses of Category 1 issues that NRC resolved using generic findings (10 CFR 51) as described in the Generic Environmental Impact Statement for License Renewal of

Nuclear Plants (GEIS) (Ref. 4.0-1). An applicant may reference the generic findings or GEIS analyses for Category 1 issues. Appendix A of this report lists the 92 issues and identifies the environmental report section that addresses each issue.

Category 1 and NA License Renewal Issues

NRC

"The environmental report for the operating license renewal stage is not required to contain analyses of the environmental impacts of the license renewal issues identified as Category 1 issues in Appendix B to subpart A of this part." 10 CFR 51.53(c)(3)(i)

"…[A]bsent new and significant information, the analyses for certain impacts codified by this rulemaking need only be incorporated by reference in an applicant's environmental report for license renewal…." (Ref. 4.0-2, pg. 28483)

Dominion Nuclear Connecticut (DNC) has determined that, of the 69 Category 1 issues, 13 do not apply to MPS because they apply to design or operational features that do not exist at the facility. In addition, because DNC does not plan to conduct any refurbishment activities, the NRC findings for the 7 Category 1 issues that apply only to refurbishment do not apply. Appendix A Table A-1 lists these 20 issues and explains the DNC basis for determining that these issues are not applicable to MPS.

Appendix A Table A-1 also lists the 49 Category 1 issues that DNC has determined to be applicable to MPS. The table includes the findings that NRC codified and references to supporting GEIS analysis. DNC is unaware of any new and significant information that would make the NRC findings inapplicable to MPS. Therefore, DNC adopts by reference the NRC findings for these Category 1 issues.

"NA" License Renewal Issues

NRC determined that its categorization and impact-finding definitions did not apply to Issues 60 and 92; however, DNC included these issues in Table A-1. NRC noted that applicants currently do not need to submit information on Issue 60, chronic effects from electromagnetic fields (10 CFR 51). For Issue 92, environmental justice, NRC does not require information from applicants, but noted that it will be addressed in individual license renewal reviews (10 CFR 51). DNC has included environmental justice demographic information in Section 2.6.2.

Category 2 License Renewal Issues

NRC

"The environmental report must contain analyses of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with license renewal and the impacts of operation during the renewal term, for those issues identified as Category 2 issues in Appendix B to subpart A of this part." 10 CFR 51.53(c)(3)(ii)

"The report must contain a consideration of alternatives for reducing adverse impacts, as required by § 51.45(c), for all Category 2 license renewal issues…." 10 CFR 51.53(c)(3)(iii)

NRC designated 21 issues as Category 2. Sections 4.1 through 4.20 address each of the Category 2 issues, beginning with a statement of the issue. As is the case with Category 1 issues, six Category 2 issues apply to operational features that MPS does not have. In addition, four Category 2 issues apply only to refurbishment activities. If the issue does not apply to MPS, the section explains the basis for inapplicability.

For the 11 Category 2 issues that DNC has determined to be applicable to MPS, the appropriate sections contain the required analyses. These analyses include conclusions regarding the significance of the impacts relative to the renewal of the operating license for MPS and, if applicable, discuss potential mitigative alternatives to the extent required. DNC has identified the significance of the impacts associated with each issue as either small, moderate, or large, consistent with the criteria that NRC established in 10 CFR 51, Appendix B, Table B-1, Footnote 3 as follows:

> SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.
>
> MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource.
>
> LARGE - Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

DNC considered ongoing and potential additional mitigation in proportion to the significance of the impact to be addressed (i.e., impacts that are small receive less mitigative consideration than impacts that are large).

4.1 Water Use Conflicts (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a Small River with Low Flow)

NRC

"If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river whose annual flow rate is less than 3.15×10^{12} ft^3 / year…., an assessment of the impact of the proposed action on the flow of the river and related impacts on instream and riparian ecological communities must be provided... The applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow..." 10 CFR 51.53(3)(ii)(A)

"The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on instream and riparian communities near these plants could be of moderate significance in some situations." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 13

The issue of surface water use conflicts does not apply to MPS because the plant does not use cooling towers or cooling ponds, or withdraw water from a small river. As Section 3.1.2 describes, MPS uses a once-through cooling system that withdraws water from the Niantic Bay (a part of Long Island Sound).

4.2 Entrainment of Fish and Shellfish in Early Life Stages

NRC

"If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations…or equivalent State permits and supporting documentation. If the applicant can not provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from…entrainment." 10 CFR 51.53(c)(3)(ii)(B)

"The impacts of entrainment are small in early life stages at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. Further, ongoing efforts in the vicinity of these plants to restore fish populations may increase the numbers of fish susceptible to intake effects during the license renewal period, such that entrainment studies conducted in support of the original license may no longer be valid." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 25

NRC made impacts on fish and shellfish resources resulting from entrainment a Category 2 issue, because it could not assign a single significance level to the issue. The impacts of entrainment are small at many plants, but they may be moderate or large at others. Also, ongoing restoration efforts may increase the number of fish susceptible to intake effects during the license renewal period (Ref. 4.0-1, Section 4.2.2.1.2). Information needing to be ascertained includes: (1) type of cooling system (whether once-through or cooling pond), and (2) status of Clean Water Act (CWA) Section 316(b) determination or equivalent state documentation.

As Section 3.1.2 describes, Millstone Power Station has a once-through heat dissipation system that withdraws water from Niantic Bay (part of Long Island Sound) for condenser cooling and discharges back to Long Island Sound.

Section 316(b) of the CWA requires that any standard established pursuant to Sections 301 or 306 of the CWA shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts (33 USC 1326). Entrainment through the condenser cooling system of fish and shellfish in early life stages is a potential adverse environmental impact. The National Pollutant Discharge Elimination System (NPDES) permit (Appendix B) issued by the Connecticut Department of Environmental Protection (CDEP) to Northeast Nuclear Energy Company for MPS in December 1992 and transferred to DNC on March 31, 2001, constitutes the current CWA Section 316(b) Determination for MPS.

CDEP administers the NPDES permit program for the state of Connecticut. The NPDES permit (CT0003263) issued to Northeast Nuclear Energy Company for Millstone Nuclear Power Station Units 1, 2, and 3 on December 14, 1992 finds (pg. 2) that:

> "The Commissioner has determined that the location, design, construction and capacity of the cooling water intake structure represents the best available technology for minimizing adverse environmental impact from impingement and entrainment pursuant to Section 316(b) of the Federal Act. The Commissioner has also determined that additional evidence based upon actual operating experience at Millstone Nuclear Power Station, Units 1, 2, and 3 would be desirable in order to corroborate the Commissioner's findings. Such data will be generated by the studies to be conducted pursuant to paragraphs 5 and 8 of this permit."

Paragraph 5 of the NPDES permit describes the scope of work of the required studies:

> "The permittee shall conduct or continue to conduct biological studies of the supplying and receiving waters, entrainment studies, and intake impingement monitoring. The studies shall include studies of intertidal and subtidal benthic communities, finfish communities, and entrained plankton and shall include detailed studies of lobster populations and winter flounder populations."

Paragraph 8 describes the reporting requirements:

> On or before January 31, 1993 submit for the review and approval of the Commissioner a report on alternatives to reduce entrainment of winter flounder larvae in accordance with "Scope of Work for Cooling Water Alternatives Feasibility Study to Reduce Larval Winter Flounder Entrainment, May 1992."

The NPDES permit is included in Appendix B.

The *Feasibility Study of Cooling Water System Alternatives to Reduce Winter Flounder Entrainment at Millstone Units 1, 2, and 3* (Ref. 4.2-1) was prepared by MPS and submitted to CDEP in January 1993 and approved in 1994. The 1993 Feasibility Study evaluated the technical feasibility and potential effectiveness of a number of alternatives to the existing cooling water system, including a natural draft cooling tower, an offshore intake, fine-mesh intake screens, wedge-wire screens, operational changes (reduced power during spawning season, scheduling refueling outages for spawning season, forced outages during spawning season), and "replenishment" (rearing and stocking) of fish.

The Feasibility Study concluded that:

> "Mitigation of larval entrainment mortality by any technology would have minimal effects, as demonstrated by the SPDM (stochastic population dynamics model) simulations. Model results indicate that the planned reduction in fishing would be the primary factor responsible for increases in the Niantic River winter female flounder spawning stock, rather than concurrent entrainment mitigation…Open-cycle cooling using the existing intake structures and equipment at MNPS remains the best available

technology at a reasonable economic cost with respect to larval winter flounder entrainment." (Ref. 4.2-1; ES-10 and 11).

While approving the study, CDEP (Ref. 4.2-3) required Millstone to:

- "...continue efforts to schedule refueling outages to coincide with the period of high winter flounder larvae abundance..."
- "continue to monitor Niantic River winter flounder population characteristics, in accordance with [the terms of the NPDES permit]."

In June 1997, Millstone filed a timely NPDES permit renewal application. In November 1999, CDEP notified NNEC that a new cooling water alternatives study would be required prior to reissuance of the MPS NPDES permit. At the request of CDEP, the study scope approved in November 2000 included an assessment of winter flounder, tautog, Atlantic menhaden, anchovies, grubby, cunner, and American sand lance.

The study, entitled An Evaluation of Cooling Water System Alternatives (Ref. 4.2-2), was completed and submitted to CDEP in August 2001. As part of the permit review process, CDEP has retained ESSA Technologies, Ltd. to assist in the review of the DNC study.

DNC's NPDES permit renewal application remains under review with the CDEP, and the current NPDES permit and 316(b) determination remain in effect until the State acts on DNC's application for renewal of the NPDES permit. Accordingly, the NPDES permit (Appendix B) issued by CDEP to NNEC for MPS in December 1992 and transferred to DNC on March 31, 2001 constitutes the current CWA Section 316(b) determination for MPS.

Based on the 316(b) determination in the current NPDES permit, DNC concludes that the impacts of entrainment are SMALL and do not require mitigation beyond those measures that are required by the NPDES permit, as periodically amended.

Entrainment reduction strategies are being reviewed as part of the permit renewal process. Any entrainment reduction strategies implemented by DNC would not change DNC's conclusion that entrainment during the license renewal term would result in SMALL impacts.

4.3 Impingement of Fish and Shellfish

NRC

"If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations…or equivalent State permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from…impingement…." 10 CFR 51.53(c)(3)(ii)(B)

"The impacts of impingement are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 26

NRC made impacts on fish and shellfish resources resulting from impingement a Category 2 issue because it could not assign a single significance level to the issue. The impacts of impingement are small at many plants, but they may be moderate or large at others (Ref. 4.0-1, Section 4.2.2.1.3). Information needing to be ascertained includes: (1) type of cooling system (whether once-through or cooling pond), and (2) status of CWA Section 316(b) determination or equivalent state documentation.

As Section 3.1.2 describes, MPS has a once-through heat dissipation system that withdraws water from Niantic Bay for condenser cooling and discharges to Long Island Sound. Also, as described in Section 3.1.2, Units 2 and 3 have fish return sluice ways that return impinged fish to Niantic Bay, minimizing the effects of impingement. Section 4.2 discusses CWA Section 316(b) studies prepared in 1993 and 2001. Appendix B contains the current NPDES permit, including the determination "that the location, design, construction, and capacity of the cooling water intake structure represent best available technology for minimizing adverse environmental impacts from impingement and entrainment, pursuant to Section 316(b) of the Federal [Clean Water] Act." Based on this 316(b) determination (made by the State upon consideration of periodic confirmatory studies), DNC concludes that the impacts due to impingement of fish and shellfish are SMALL and do not require further mitigation.

4.4 Heat Shock

NRC

"If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(a) variance in accordance with 40 CFR 125, or equivalent State permits and supporting documentation. If the applicant can not provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock…." 10 CFR 51.53(c)(3)(ii)(B)

"Because of continuing concerns about heat shock and the possible need to modify thermal discharges in response to changing environmental conditions, the impacts may be of moderate or large significance at some plants." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 27

NRC made impacts on fish and shellfish resources resulting from heat shock a Category 2 issue, because of continuing concerns about thermal discharge effects and the possible need to modify thermal discharges in the future in response to changing environmental conditions (Ref. 4.0-1, Section 4.2.2.1.4). Information to be ascertained includes: (1) type of cooling system (whether once-through or cooling pond), and (2) evidence of a CWA Section 316(a) variance or equivalent state documentation.

As Section 3.1.2 describes, MPS has a once-through heat dissipation system that withdraws water from Niantic Bay for condenser cooling and discharges to Long Island Sound. As discussed below, DNC also has a Section 316(a) variance for MPS discharges.

Section 316(a) of the CWA establishes a process whereby a discharger can demonstrate that established thermal discharge limitations are more stringent than necessary to protect a balanced indigenous population of fish and wildlife and obtain facility-specific thermal discharge limits (33 USC 1326). The Connecticut Department of Environmental Protection administers the NPDES permit program for the state of Connecticut. The NPDES permit (CT0003263) issued to Northeast Nuclear Energy Company for Millstone Nuclear Power Station Units 1, 2, and 3 on December 14, 1992 states (pg. 1) that:

"The Commissioner of Environmental Protection has determined that the effluent limitations which would require the use of cooling systems at the Millstone Nuclear Power Station Units 1, 2, and 3 other than the existing once-through system utilized by the applicant for the control of the thermal component of the applicant's discharge are more stringent than necessary to assure the protection of shellfish, fish, and wildlife in and on the receiving waters. In the view of this finding, the Commissioner has herein established alternative and less stringent effluent limitations in accordance with Section 316(a) of the Clean Water Act."

The NPDES permit also requires continued monitoring of the supplying and receiving waters, including studies of intertidal and subtidal benthic communities and finfish communities and “detailed studies” of lobster and winter flounder populations.

In renewing the Station’s NPDES permit at that time, the CDEP determined that thermal discharges from MPS were sufficiently protective of fish and wildlife communities of Niantic Bay and eastern Long Island Sound to allow alternative thermal effluent limitations under Section 316(a) of the CWA. This determination was based on numerous hydrothermal and biological studies over a 20-plus year period and on-going ecological monitoring programs.

As noted previously, Millstone submitted an application for renewal of the MPS NPDES permit in 1997. The current NPDES permit (provided in Appendix B) and its Section 316(a) variance remain in effect until the CDEP acts on Millstone’s application. Based on the 316(a) variance, supported by the confirmatory information in studies conducted since 1992, DNC concludes that impacts to fish and shellfish from heat shock are SMALL and warrant no additional mitigation.

4.5 Groundwater Use Conflicts (Plants Using > 100 gpm of Groundwater)

NRC

"If the applicant's plant…pumps more than 100 gallons (total onsite) of groundwater per minute, an assessment of the impact of the proposed action on groundwater use must be provided." 10 CFR 51.53(c)(3)(ii)(C)

"Plants that use more than 100 gpm may cause groundwater use conflicts with nearby groundwater users." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 33

The issue of groundwater use conflicts at plants that pump more than 100 gallons per minute of groundwater does not apply to MPS. One on-site groundwater well is used on a seasonal basis for irrigating approximately 30 acres of ballfields (Section 2.3). Based on its depth (22 feet), pump horsepower, and capacity of pumps with identical horsepower, Dominion concludes that the capacity is much less than 100 gallons per minute.

As Section 3.1.2 describes, the plant obtains all its cooling and service system water from Niantic Bay (a part of Long Island Sound), and gets its potable water from the City of New London.

4.6 Groundwater Use Conflicts (Plants Using Cooling Towers or Cooling Ponds Withdrawing Makeup Water from a Small River)

NRC

"If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river whose annual flow rate is less than 3.15×10^{12} ft^3/ year…. The applicant shall also provide an assessment of the impact of the withdrawal of water from the river on alluvial aquifers during low flow." 10 CFR 51.53(3)(ii)(A)

"Water use conflicts may result from surface water withdrawals from small water bodies during low flow conditions which may affect aquifer recharge, especially if other groundwater or upstream surface water users come on line before the time of license renewal." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 34

The issue of groundwater use conflicts does not apply to MPS because the plant does not use cooling towers or cooling ponds and does not withdraw water from a small river. As Section 3.1.2 describes, MPS uses a once-through cooling system with intakes on Niantic Bay (a part of Long Island Sound), and surface discharges to the old quarry. Water from the quarry flows back into Long Island Sound.

4.7 Groundwater Use Conflicts (Plants Using Ranney Wells)

NRC

"If the applicant's plant uses Ranney wells…an assessment of the impact of the proposed action on groundwater use must be provided." 10 CFR 51.53(c)(3)(ii)(C)

"Ranney wells can result in potential groundwater depression beyond the site boundary. Impacts of large groundwater withdrawal for cooling tower makeup at nuclear power plants using Ranney wells must be evaluated at the time of application for license renewal." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 35

The issue of groundwater use conflicts does not apply to MPS because the plant does not use Ranney wells. As Section 3.1.2 describes, MPS uses a once-through cooling system with intakes on Niantic Bay (a part of Long Island Sound), and surface discharges to the old quarry. Water from the quarry flows back into Long Island Sound.

4.8 Degradation of Groundwater Quality

NRC

"If the applicant's plant is located at an inland site and utilizes cooling ponds…an assessment of the impact of the proposed action on groundwater quality must be provided." 10 CFR 51.53(c)(3)(ii)(D)

"Sites with closed cycle cooling ponds may degrade groundwater quality. For plants located inland, the quality of the groundwater in the vicinity of the ponds must be shown to be adequate to allow continuation of current uses." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 39

The issue of groundwater degradation does not apply to MPS because the plant is not located at an inland site and does not use cooling ponds. As Section 3.1.2 describes, MPS uses a once-through cooling system with intakes on Niantic Bay (a part of Long Island Sound), and surface discharges to Long Island Sound via the old quarry.

4.9 Impacts of Refurbishment on Terrestrial Resources

NRC

The environmental report must contain an assessment of "…the impacts of refurbishment and other license renewal-related construction activities on important plant and animal habitats." 10 CFR 51.53(c)(3)(ii)(E)

"Refurbishment impacts are insignificant if no loss of important plant and animal habitat occurs. However, it cannot be known whether important plant and animal communities may be affected until the specific proposal is presented with the license renewal application." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 40

"…If no important resources would be affected, the impacts would be considered minor and of small significance. If important resources could be affected by refurbishment activities, the impacts would be potentially significant." (Ref. 4.0-1, Section 3.6)

The issue of impacts of refurbishment on terrestrial resources is not applicable to MPS because, as discussed in Section 3.2, Dominion has no plans for refurbishment or other license-renewal-related construction activities at MPS.

4.10 Threatened and Endangered Species

NRC

"Additionally, the applicant shall assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act." 10 CFR 51.53(c)(3)(ii)(E)

"Generally, plant refurbishment and continued operation are not expected to adversely affect threatened or endangered species. However, consultation with appropriate agencies would be needed at the time of license renewal to determine whether threatened or endangered species are present and whether they would be adversely affected." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 49

NRC made impacts to threatened and endangered species a Category 2 issue because the status of many species is being reviewed, and site-specific assessment is required to determine whether any identified species could be affected by refurbishment activities or continued plant operations through the renewal period. In addition, compliance with the Endangered Species Act requires consultation with the appropriate federal agency (Ref. 4.0-1, Sections 3.9 and 4.1).

DNC has concluded that no listed species would be adversely affected as a result of continued operations. Section 2.2 of this Environmental Report describes the aquatic communities of marine waters at Millstone Point. Section 2.4 describes important terrestrial habitats at MPS and along the associated transmission corridors. Section 2.5 discusses threatened or endangered species that occur or may occur at MPS and along associated transmission corridors, or waters off Millstone Point.

With the exception of the species identified in Section 2.5, DNC is not aware of any threatened or endangered terrestrial species that occur at MPS or along the associated transmission corridors, or of any critical habitat in these corridors. Current operations of MPS and Northeast Utilities vegetation management practices along transmission line rights-of-way do not adversely affect any listed terrestrial species or its habitat (see Section 2.4). Furthermore, station operations and transmission line maintenance practices are not expected to change significantly during the license renewal term. Therefore, no significant adverse environmental impacts to threatened or endangered terrestrial species from current or future operations, and no destruction or adverse modifications of any critical habitat are anticipated.

DNC has conducted extensive population studies of fish and shellfish in the vicinity of MPS since 1970 to assess operational impacts. With the exception of one Atlantic sturgeon (state-threatened) collected in 1980 and released, as discussed in Section 2.5, no state- or federally-listed fish species has been collected or observed in more than 30 years of monitoring.

As noted in Section 2.5, eight threatened and endangered marine species (three great whales and five sea turtles) pass south of Long Island during seasonal migrations and occasionally enter Long Island Sound. The whales live and forage over the continental shelf, approaching the coastline only during seasonal migrations. Great whales only rarely feed in Long Island Sound, and DNC is not aware of any great whales in the vicinity of MPS. Because whales are not known to move into the shallow waters immediately offshore of MPS, they are not affected by operation of the MPS cooling water intake system or by the station's discharge. There is no evidence that operation of MPS has had an effect on whales in Long Island Sound.

Sea turtles are more likely to move inshore and feed in shallow coastal waters, but reports of sea turtles near MPS are rare. Although some sea turtles are stranded every year on New England beaches, DNC is not aware of any strandings on or near MPS. No sea turtles have been impinged at MPS, and there is no indication that the effluent has disrupted normal seasonal movement or migration of turtles. For these reasons, continued operations during the period of license renewal is not expected to have any adverse effects on threatened or endangered aquatic species.

DNC communicated with the Connecticut Department of Environmental Protection, the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service requesting information on any listed species or critical habitats that might occur on the MPS site or along the associated transmission corridors, with particular emphasis on species that might be adversely affected by continued operation over the license renewal period. Agency responses are provided in Appendix C.

As discussed in Section 3.2, DNC has no plans to conduct refurbishment or construction activities at MPS during the license renewal term. Therefore, there would be no refurbishment-related impacts to special-status species and no further analysis of refurbishment-related impacts is applicable. Furthermore, because DNC has no plans to alter current operations and resource agencies contacted by DNC evidenced no serious concerns about license renewal impacts, DNC concludes that impacts to threatened or endangered species from license renewal would be SMALL and do not warrant mitigation. Renewal of the MPS operating licenses is not likely to jeopardize the continued existence of any endangered or threatened species or to result in the destruction or adverse modifications of any critical habitats.

4.11 Air Quality during Refurbishment

NRC

"If the applicant's plant is located in or near a nonattainment or maintenance area, an assessment of vehicle exhaust emissions anticipated at the time of peak refurbishment workforce must be provided in accordance with the Clean Air Act as amended." 10 CFR 51.53(c)(3)(ii)(F)

"Air quality impacts from plant refurbishment associated with license renewal are expected to be small. However, vehicle exhaust emissions could be cause for concern at locations in or near nonattainment or maintenance areas. The significance of the potential impact cannot be determined without considering the compliance status of each site and the numbers of workers expected to be employed during the outage." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 50

The NRC made impacts to air quality during refurbishment a Category 2 issue because vehicle exhaust emissions could be cause for some concern, and a general conclusion about the significance of the potential impact could not be drawn without considering the compliance status of each site and the number of workers expected to be employed during an outage (Ref. 4.0-1, Section 3.3).

Air quality during refurbishment is not applicable to Millstone Power Station because, as discussed in Section 3.2, Dominion has no plans for major refurbishment or replacement actions at Millstone Power Station.

4.12 Impact on Public Health of Microbiological Organisms

NRC

"If the applicant's plant uses a cooling pond, lake, or canal or discharges into a river having an annual average flow of less than $3.15 \times 10^{12} ft^3$/year ($9 \times 10^{10} m^3$/year), an assessment of the proposed action on public health from thermophilic organisms in the affected water must be provided." 10 CFR 51.53(c)(3)(ii)(G)

"These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals that discharge to small rivers. Without site-specific data, it is not possible to predict the effects generically." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 57

The issue of microbiological thermophilic organisms does not apply to MPS because the plant does not use a cooling pond, lake, or canal that discharges to a small river. As described in Section 3.1.2, MPS uses a once-through cooling system with intakes on Niantic Bay (a part of Long Island Sound), and surface discharges to the old quarry. Water from the quarry flows back into Long Island Sound.

4.13 Electric Shock from Transmission-Line-Induced Currents

NRC

The environmental report must contain an assessment of the impact of the proposed action on the potential shock hazard from transmission lines "[i]f the applicant's transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the National Electric Safety Code for preventing electric shock from induced currents." 10 CFR 51.53(c)(3)(ii)(H)

"Electrical shock resulting from direct access to energized conductors or from induced charges in metallic structures have not been found to be a problem at most operating plants and generally are not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electric shock potential at the site." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 59

NRC made impacts of electric shock from transmission lines a Category 2 issue because, without a review of each plant's transmission line conformance with the National Electrical Safety Code (NESC) (Ref. 4.13-1) criteria, NRC could not determine the significance of the electrical shock potential. In the case of Millstone, there have been no previous NRC or NEPA analyses of transmission-line-induced-current hazard. Therefore, this section discusses Millstone's transmission lines' conformance with the NESC standard.

Conducting objects near transmission lines can become electrically charged due to their immersion in the lines' electric field. This charge results in a current that flows through the object to the ground. The current is called "induced" because there is no direct connection between the line and the object. The induced current can also flow to the ground through the body of a person who touches the object. An object that is insulated from the ground can actually store an electrical charge, becoming what is called "capacitively charged." A person standing on the ground and touching a vehicle or a fence receives an electrical shock due to the discharge of the capacitive charge through the person's body to the ground. After the initial discharge, a steady-state current can develop the magnitude of which depends on several factors, including the following:

- the strength of the electric field which, in turn, depends on the voltage of the transmission line as well as its height and geometry
- the size of the charged object and its orientation with respect to the line
- the extent to which the object is electrically insulated from ground
- the extent to which the person in contact with the object is electrically insulated from ground.

In 1977, the NESC adopted a provision that describes a criterion to establish minimum vertical clearances to the ground for electric lines having voltages exceeding 98-kilovolt (kV)

alternating current to ground. The clearance must limit the steady-state induced current to 5 milliamperes if the largest anticipated truck, vehicle, or equipment were short-circuited to ground. By way of comparison, the setting of ground fault circuit interrupters used in residential wiring (special breakers for outside circuits or those with outlets around water pipes) is 4 to 6 milliamperes.

As described in Section 3.1.3, there are four 345-kV lines that were specifically constructed to distribute power from Millstone to the electric grid. Three of the lines were designed and constructed before NESC promulgated the 5 milliampere rule on induced current. The Manchester line was energized in 1985 and was designed in accordance with the 1977 or later edition of the NESC. The four transmission lines are not owned by Dominion but are owned and maintained by Connecticut Light and Power; they will continue to be used by Connecticut Light and Power after Millstone is decommissioned.

In 1987, a parking lot for the Cross Road Mall was constructed under the four Millstone transmission lines, just north of I-95, approximately 4 miles north of the plant. The grade of the parking lot is such that clearance under the lines is slightly reduced from the original construction. Connecticut Light and Power conducted extensive studies of the electric shock potential in the parking lot and has concluded that the lines in this location are constructed in accordance with NESC provisions for limiting induced current shock, including vehicles that use this area (Ref. 4.13-2; reference 104). As additional measures to mitigate the potential for perceptible (but NESC-compliant) shocks, Connecticut Light and Power specified: construction of islands to block parking in regions where the electric field strength would be greatest; only car-sized parking spaces within the right-of-way and oriented perpendicular to the power lines; the locations and types of light poles and sewer gratings within the right-of-way.

Although Dominion has not conducted induced current studies along the entire 90 miles of Connecticut Light and Power's applicable transmission line corridors, the Cross Road Mall is the most probable location for induced current shock. There have been instances of perceptible (but NESC-compliant) shock (i.e., initial contact discharge and/or steady-state contact current) in the mall parking lot, whereas, there is no indication that induced current shock has been an issue anywhere else along these transmission lines.

Connecticut Light and Power conducts surveillance and maintenance to assure that design ground clearances will not change. These procedures include routine airplane inspection on a regular basis. The aerial patrols of all corridors include checks for encroachments, broken conductors, broken or leaning structures, and signs of trees burning, any of which would be evidence of clearance problems. Ground inspections include examination for clearance at questionable locations, integrity of structures, and surveillance for dead or diseased trees

that might fall on the transmission lines. Problems noted during any inspection are brought to the attention of the appropriate organizations for corrective action.

Dominion's assessment under 10 CFR 51 concludes that electric shock is of SMALL significance for the Millstone transmission lines. This is because (1) the lines conform to NESC provisions at the location of greatest induced-shock probability, (2) the transmission lines would continue to be used regardless of license renewal, and (3) the proposed action has no effect on the current status of the lines. Due to the small significance of the issue, additional mitigation measures such as installing warning signs at road crossings or increasing clearances are not warranted. This conclusion would remain valid into the future, provided there are no changes in line use, voltage, current, and maintenance practices and no changes in land use under the lines.

4.14 Housing Impacts

NRC

The environmental report must contain "[a]n assessment of the impact of the proposed action on housing availability…."10 CFR 51.53(c)(3)(ii)(l)

"Housing impacts are expected to be of small significance at plants located in a medium or high population area and not in an area where growth control measures that limit housing development are in effect. Moderate or large housing impacts of the workforce associated with refurbishment may be associated with plants located in sparsely populated areas or areas with growth control measures that limit housing development." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 63

"...[S]mall impacts result when no discernible change in housing availability occurs, changes in rental rates and housing values are similar to those occurring statewide, and no housing construction or conversion occurs." (Ref. 4.0-1, Section 4.7.1).

NRC made housing impacts a Category 2 issue because the magnitude of any impact would depend on local conditions that the NRC could not predict for all plants at the time of GEIS publication (Ref. 4.0-1, Section 3.7.2). Local conditions that need to be ascertained are: (1) population categorization as small, medium, or high, and (2) applicability of growth control measures.

As described in Section 3.2 DNC does not plan to perform any refurbishment activities. Therefore, DNC concludes that there would be no refurbishment-related impacts to area housing, and no analysis is required.

As noted in 10 CFR 51, Subpart A, Appendix B, Table B-1, NRC concluded that impacts to housing are expected to be of small significance at plants located in high population areas where growth control measures are not in effect. As described in Section 2.6, MPS is located in a high population area. As described in Section 3.4, DNC plans to add no more than five additional permanent employees during the license renewal term. DNC's analysis of the towns' planning tools (Section 2.9), such as zoning and redevelopment incentives, determined that some are applying growth control measures designed to guide growth. However, DNC concludes that impacts to housing availability from a plant population growth of one to five employees would be SMALL and would not warrant mitigation.

4.15 Public Utilities: Public Water Supply Availability

NRC

The environmental report must contain "…an assessment of the impact of population increases attributable to the proposed project on the public water supply." 10 CFR 51.53(c)(3)(ii)(l)

"An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 65

"Impacts on public utility services are considered small if little or no change occurs in the ability to respond to the level of demand and thus there is no need to add to capital facilities. Impacts are considered moderate if overtaxing of facilities during peak demand periods occurs. Impacts are considered large if existing service levels (such as quality of water and sewage treatment) are substantially degraded and additional capacity is needed to meet ongoing demands for services." Ref. 4.0-1, Section 3.7.4.5

NRC made public utility impacts a Category 2 issue because an increased problem with water availability, resulting from pre-existing water shortages, could occur in conjunction with plant demand and plant-related population growth (Ref. 4.0-1, Section 4.7.3.5). Local information needed would be: (1) description of water shortages experienced in the area, and (2) an assessment of the public water supply system's available capacity. NRC's analysis of impacts to the public water supply system considered both plant demand and plant-related population growth demands on water resources.

Section 3.4 explains why DNC anticipates no more than five additional employees during the license term and describes the distribution of the population associated with license renewal activities. MPS water usage is not expected to change during the license renewal period. Section 2.9.1 describes the public water supply systems potentially affected by license renewal activities.

As described in Section 3.2, no refurbishment activities are planned for MPS and, therefore, no refurbishment impacts are expected and no analysis is needed.

Section 2.9.1 notes that average daily water withdrawals are near authorized withdrawal limits (capacities) in some areas. The region overall has excess capacity, but is expected to eventually experience water shortages in some areas.

MPS acquires potable water from the city of New London. MPS's 2000-2001 potable water usage averaged 332,000 gallons per day. This usage represents approximately 5.2 percent of the city of New London's daily capacity (see Table 2-7) and 6 percent of the city's average daily use. DNC does not expect MPS operations to have any change in impact on local water supplies. Adding direct and indirect employees (as a result of 5 additional license renewal employees) would not significantly impact the excess capacity in the region's water supplies.

Although future water shortages are a concern for the region, their occurrence would be independent of the license renewal process. Therefore, DNC concludes that impacts to the public water supply from plant-related population growth and plant demand would be SMALL and mitigation would not be warranted.

4.16 Education Impacts from Refurbishment

NRC

The environmental report must contain "…an assessment of the impact of the proposed action on public schools (impacts from refurbishment activities only) within the vicinity of the plant…." 10 CFR 51.53(c)(3)(ii)(l)

"Most sites would experience impacts of small significance but larger impacts are possible depending on site- and project-specific factors." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 66

"…[S]mall impacts are associated with project-related enrollment increases of 3 percent or less. Impacts are considered small if there is no change in the school systems' abilities to provide educational services and if no additional teaching staff or classroom space is needed. Moderate impacts are associated with 4 to 8 percent increases in enrollment, and if a school system must increase its teaching staff or classroom space even slightly to preserve its pre-project level of service…. Large impacts are associated with enrollment increases greater than 8 percent." Ref. 4.0-1, Section 3.7.4.1

The issue of impacts to the local education system due to refurbishment is not applicable to MPS because, as Section 3.2 discusses, Dominion has identified no refurbishment needs at MPS.

4.17 Offsite Land Use

4.17.1 Offsite Land Use - Refurbishment

NRC

The environmental report must contain "…[a]n assessment of the impact of the proposed action on… land-use…." 10 CFR 51.53(c)(3)(ii)(I)

"Impacts may be of moderate significance at plants in low population areas." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 68

"…[I]f plant-related population growth is less than 5 percent of the study area's total population, off-site land-use changes would be small, especially if the study area has established patterns of residential and commercial development, a population density of at least 60 persons per square mile, and at least one urban area with a population of 100,000 or more within 50 miles." (Ref. 4.0-1, Section 3.7.5)

This issue is not applicable to MPS because, as Section 3.2 discusses, DNC has no plans for refurbishment at MPS.

4.17.2 Offsite Land Use - License Renewal Term

NRC

The environmental report must contain "…[a]n assessment of the impact of the proposed action on…land-use…." 10 CFR 51.53(c)(3)(ii)(I)

"Significant changes in land use may be associated with population and tax revenue changes resulting from license renewal." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 69

"…[I]f plant-related population growth is less than five percent of the study area's total population, off-site land-use changes would be small…." (Ref. 4.0-1, Section 3.7.5)

"…[I]f the plant's tax payments are projected to be a dominant source of the community's total revenue, new tax-driven land-use changes would be large. This would be especially true where the community has no pre-established pattern of development or has not provided adequate public services to support and guide development in the past." (Ref. 4.0-1, Section 4.7.4.1)

NRC made impacts to offsite land use during the license renewal term a Category 2 issue, because land-use changes may be perceived as beneficial by some community members and detrimental by others. Therefore, NRC could not assess the potential significance of site-specific offsite land-use impacts (Ref. 4.0-1, Section 4.7.4.2). Site-specific factors to consider in an assessment of land-use impacts include: (1) the size of plant-related population growth compared to the area's total population, (2) the size of the plant's tax payments relative to the community's total revenue, (3) the nature of the community's

existing land-use pattern, and (4) the extent to which the community already has public services in place to support and guide development.

The GEIS presents an analysis of offsite land use for the renewal term that is characterized by two components: population-driven and tax-driven impacts (Ref. 4.0-1, Section 4.7.4.1).

Population-Related Impacts

Based on the GEIS case-study analysis, NRC concluded that all new population-driven land-use changes during the license renewal term at all nuclear plants would be small. Population growth caused by license renewal would represent a much smaller "percentage of the local area's" total population than the percent change represented by original construction-related growth (Ref. 4.0-1, Section 3.7.5). DNC agrees with the NRC conclusion that population-driven land use impacts would be SMALL. Mitigation would not be warranted.

Tax-Revenue-Related Impacts

NRC considered that the significance of tax payments as a source of local government revenue would be large if the payments are greater than 20 percent of revenue (Ref. 4.0-1, Section 3.7.3). NRC further considered that, if a plant's tax payments are projected to be a dominant source of a community's total revenue (i.e., greater than 20 percent of revenue), new tax-driven land-use changes would be large.

NRC defined the magnitude of land-use changes as follows (Ref. 4.0-1, Section 3.7.5):

- Small - very little new development and minimal changes to an area's land-use pattern
- Moderate - considerable new development and some changes to land-use pattern
- Large - large-scale new development and major changes in land-use pattern.

Table 2-4 compares the tax payments made by DNC to Waterford with the town's annual property tax revenues. DNC's tax payments to Waterford represent 36 percent of the town's total annual property tax revenues not considering the Systems Benefit Charge reimbursement. They represent 20 to 25 percent of the Town's revenues if the Systems Benefit Charge reimbursement is included in the total tax revenues. Therefore, in either case, DNC's tax payments to Waterford are large by NRC's criteria.

As described in Section 3.2, DNC does not anticipate refurbishment or construction during the license renewal period. Therefore, DNC does not anticipate any increase in the assessed value of MPS due to refurbishment-related improvements, nor any related tax-increase-driven changes to offsite land-use and development patterns.

Using the NRC methodology would lead to the conclusion that MPS operations has, and license renewal would have, large tax-driven land use impacts. However, this effect is, in fact, difficult to see. Waterford acknowledges the fiscal benefits of MPS, such as lower tax

bills, extensive infrastructure improvements, and enhanced services. The town points out that these benefits are changing due to the depreciating value of the plant and that the changes may be accelerated due to deregulation (Ref. 4.17-1, pg. 24). Thus, even if MPS is having a large effect, the effect would be expected to diminish because the tax contribution is expected to diminish.

More telling, however, is the status of land use in Waterford today. While Waterford is the only municipality that receives tax benefits from the MPS (Section 2.7), its land use patterns are not appreciably different than those of the 5 abutting municipalities. As Section 2.8 discusses, Waterford, at 18 percent urban, is less than New London (66 percent) and Groton (28 percent), and only slightly more than the other coastline municipality, East Lyme (13 percent). Consistent with the pattern in the area, the inland municipalities (Montville and Ledyard) are less developed. East Lyme has the highest population growth rate but the Waterford population growth over the past 20 years has remained equal to the county's. Overall, the regional land use patterns have remained the same as when the plant was built. An accurate observation might be that, whereas MPS tax contributions affected how Waterford has developed, the development itself has been driven by other forces that have acted equally on other municipalities in the area. For these reasons, DNC concludes that MPS license renewal would have SMALL impacts on offsite land use and that mitigation measures are not warranted.

4.18 Transportation

NRC

The environmental report must "...assess the impact of highway traffic generated by the proposed project on the level of service of local highways during periods of license renewal refurbishment activities and during the term of the renewal license." 10 CFR 51.53(c)(3)(ii)(J)

"Transportation impacts are generally expected to be of small significance. However, the increase in traffic associated with the additional workers and local road and traffic control conditions may lead to impacts of moderate or large significance at some sites." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 70

"Small impacts would be associated with a free flowing traffic stream where users are unaffected by the presence of other users (level of service A) or stable flow in which the freedom to select speed is unaffected but the freedom to maneuver is slightly diminished (level of service B)." (Ref. 4.0-1, Section 3.7.4.2)

NRC made impacts to transportation a Category 2 issue because impacts are determined primarily by road conditions existing at the time of the project, which NRC could not forecast for all facilities Ref. 4.0-1, Section 3.7.4.2). Local road conditions to be ascertained are: (1) level of service conditions and (2) incremental increase in traffic associated with refurbishment activities and license renewal staff.

As described in Section 3.2, no refurbishment is planned and no refurbishment impacts to local transportation are anticipated. No further evaluation is necessary.

As described in Section 3.4, DNC anticipates no more than 5 additional license renewal term employees. This is in addition to the station workforce of 1,550-1,650 employees and long-term contractors and a periodic outage workforce of as many as 800 additional workers. Daily traffic counts are provided in Table 2-8. Based on the information available, DNC concludes that increasing the current permanent workforce by less than 1 percent would have a SMALL incremental impact on local traffic and that no mitigation is warranted.

4.19 Historic and Archaeological Resources

NRC

The environmental report must contain an assessment of "…whether any historic or archaeological properties will be affected by the proposed project." 10 CFR 51.53(c)(3)(ii)(K)

"Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and archaeological resources. However, the National Historic Preservation Act requires the Federal agency to consult with the State Historic Preservation Officer to determine whether there are properties present that require protection." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 71

"Sites are considered to have small impacts to historic and archaeological resources if (1) the State Historic Preservation Office (SHPO) identifies no significant resources on or near the site; or (2) the SHPO identifies (or has previously identified) significant historic resources but determines they would not be affected by plant refurbishment, transmission lines, and license-renewal term operations and there are no complaints from the affected public about altered historic character; and (3) if the conditions associated with moderate impacts do not occur." (Ref. 4.0-1, Section 3.7.7)

NRC made impacts to historic and archaeological resources a Category 2 issue, because determinations of impacts to historic and archaeological resources are site-specific in nature and the National Historic Preservation Act mandates that impacts must be determined through consultation with the State Historic Preservation Officer (Ref. 4.0-1, Section 4.7.7.3).

In the FES for MPS Unit 3 operation, a letter from Mr. John W. Shannahan, State of Connecticut Historic Preservation Officer, stated that "In the opinion of the State Historic Preservation Officer the granting of an operating permit…will have no impact upon historical, architectural and archaeological resources listed on or eligible for the National Register of Historic Places" (Ref. 4.19-1, Appendix H).

As discussed in Section 3.2, DNC has no refurbishment plans and no refurbishment-related impacts are anticipated. DNC is not aware of any historic or archaeological resources that have been affected to date by MPS operations. DNC in unaware of plans by Northeast Utilities to change transmission line inspection and maintenance practices or right-of-way vegetation management practices over the license renewal term. By letter dated August 5, 2003 (Appendix D, page E-D-30), the Connecticut State Historic Preservation Office concluded that license renewal would have "no effect on historic, architectural, or archaeological resources listed on or eligible for the National Register of Historic Places." Based on the fact that current practices are not expected to change significantly (there may well be minor changes in inspection and surveillance procedures, vegetation management procedures, etc.), DNC concludes that impacts of operation of these same generation and transmission facilities over the license renewal term on cultural resources would be SMALL; hence, no mitigation would be warranted.

4.20 Severe Accident Mitigation Alternatives (SAMAs)

NRC Input

The environmental report must contain a consideration of alternatives to mitigate severe accidents "... if the staff has not previously considered severe accident mitigation alternatives for the applicant's plant in an environmental impact statement or related supplement or in an environmental assessment..." 10 CFR 51.53(c)(3)(ii)(L)

"... The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives..." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 76

The term "accident" in the current context refers to any unintentional event (i.e., outside the normal or expected plant operational parameters) that results in the release or the potential for release of radioactive material to the environment. Generally, NRC categorizes accidents as "design-basis" or "severe." Design-basis accidents are those for which the risk is great enough that an applicant is required to design and construct a plant to prevent unacceptable accident consequences. Severe accidents are those considered too unlikely to warrant design controls.

Historically, NRC has not included in its environmental impact statements or environmental assessments any analysis of alternative ways to mitigate the environmental impact of severe accidents. A 1989 court decision ruled that, in the absence of an NRC finding that severe accidents are remote and speculative, severe accident mitigation alternatives (SAMAs) should be considered in the NEPA analysis (*Limerick Ecology Action v. NRC*, 869 F.d 719 [3rd Cir. 1989]). For most plants, including Millstone Power Station Units 2 (MPS2) and 3 (MPS3), license renewal is the first licensing action that would necessitate consideration of SAMAs.

The NRC concluded in its generic license renewal rulemaking that the unmitigated environmental impacts from severe accidents meet the Category 1 criteria. However, NRC made consideration of mitigation alternatives a Category 2 issue because ongoing regulatory programs related to mitigation (i.e., Individual Plant Examination [IPE] and Accident Management) were not complete for all plants. Because these programs have identified plant programmatic and procedural improvements (and, in a few cases, minor modifications) as cost-effective in reducing severe accident risk and consequences, NRC thought it premature to draw a generic conclusion as to whether severe accident mitigation would be required for license renewal. Site-specific information to be presented in the environmental report includes: (1) potential SAMAs; (2) benefits and costs of implementing potential SAMAs; and (3) sensitivity of analysis to changes in key underlying assumptions.

The overall approach taken in this SAMA analysis includes the following steps:

- Establish the base case - Use NUREG/BR-0184 (Ref. 4.20-1, Chapter 5) to evaluate severe accident impacts. Include: offsite exposure cost; offsite economic cost; onsite exposure cost; onsite economic cost, including both cleanup and decommissioning; and replacement power.
- Identify potential SAMAs from sources such as NRC, industry documentation that discusses potential plant improvements, plant-specific sources such as the IPE, and Individual Plant Examination – External Events (IPEEE), as well as insight provided by station probabilistic risk assessment (PRA) staff.
- Qualitatively screen potential SAMAs. Eliminate obviously non-viable candidates, based on objective screening criteria.
- Perform benefit/cost evaluations for remaining SAMAs. Calculate the net value of implementing each remaining SAMA by subtracting the cost of implementing each SAMA from the benefit of each SAMA (averted offsite exposure and economic costs, as well as onsite exposure and economic costs).
- Identify any SAMAs having positive net values.

The plant-specific SAMA analyses are presented in the following sections and in Appendix F (for MPS2) and Appendix G (for MPS3), providing a detailed discussion of the process presented above.

4.20.1 **Establishing the Base Case**

The purpose of establishing the base case is to provide the baseline for determining risk reductions that would be attributable to the implementation of potential SAMAs. This severe accident risk, based on the plant-specific PRA model, is evaluated in terms of dollars by using PRA analysis techniques. This analysis includes three levels. The first two levels are defined as follows: Level 1 determines core damage frequencies based on system analyses and human-factor evaluations; and Level 2 determines the physical and chemical phenomena that affect the performance of the containment and other radiological release mitigation features to quantify accident behavior and release of fission products to the environment. The primary source of data relating to the Levels 1 and 2 analyses is the plant PRA model.

Using the results of these analyses, the next step is to perform a Level 3 PRA analysis, which calculates the hypothetical impacts of severe accidents on the surrounding environment and members of the public. The Level 3 analysis was performed using the Melcor Accident Consequence Code System (MACCS2). MACCS2 simulates the impact of severe accidents at nuclear power plants on the surrounding environment. The MACCS2

computer code is used for determining the offsite impacts for the Level 3 analysis, whereas the magnitude of the onsite impacts (in terms of clean-up and decontamination costs and occupational dose) are based on information provided in NUREG/BR-0184 (Ref. 4.20-1).

The principal phenomena analyzed are: atmospheric transport of radionuclides; mitigative actions (i.e., evacuation, condemnation of contaminated crops and milk) based on dose projection; dose accumulation by a number of pathways, including food and water ingestion; and economic costs. Input for the Level 3 analysis includes: the plant core radionuclide inventory; source terms from the PRA model; site meteorological data; projected population distribution within a 50-mile radius (for the year 2030 for MPS2 and 2040 for MPS3); emergency response evacuation modeling; and economic data. The MACCS2 input data and assumptions are described in the Appendices.

The Base Case Costs described below are quantified in Table 4-1 for Unit 2, and Table 4-2 for Unit 3.

4.20.1.1 Offsite Exposure Costs

The Level 3 base case analysis determines an annual avoided offsite exposure risk, included in Tables 4-1 (MPS2) and 4-2 (MPS3). This calculated value is converted to a monetary equivalent (dollars) via application of the NRC's conversion factor of $2,000 per person-rem (Ref. 4.20-2 and Appendices F and G). This dollar amount is then discounted to present value using NRC methodology (Ref. 4.20-1):

$$APE = (F_S D_{p_S} - F_A D_{p_A}) R \frac{1 - e^{-rt_f}}{r} \qquad (1)$$

where:

- APE = monetary value of avoided accident risk due to population doses (after discounting)
- R = monetary equivalent of unit dose ($2,000/person-rem)
- F = accident frequency (events/yr)
- D_P = population dose factor (person-rem/event)
- S = subscript denoting status quo (current conditions)
- A = subscript denoting status after implementation of proposed action
- r = real discount rate = 7 percent (as a fraction, 0.07)
- t_f = years remaining until end of facility life (20 years)

4.20.1.2 **Offsite Economic Costs**

The Level 3 analysis determines an annual offsite economic risk, shown in the tables. Calculated values of offsite economic costs caused by severe accidents are also discounted to present value. Discounting is performed in the same manner as for the public health risks in accordance with NRC methodology.

$$AOC = (F_S P_{D_S} - F_A P_{D_A}) \frac{1 - e^{-rt_f}}{r} \qquad (2)$$

where:

AOC = monetary value of avoided accident risk due to offsite property damage (after discounting)

P_D = offsite property loss factor (dollars/event)

4.20.1.3 **Onsite Exposure Costs**

Values for occupational exposure from severe accidents are not derived from the PRA model, but are instead obtained from information published by the NRC (Ref. 4.20-1, Section 5.7.3). The values for occupational exposure consist of "immediate dose" and "long-term dose." The best-estimate value provided by the NRC for immediate occupational dose is 3,300 person-rem and for long-term occupational dose is 20,000 person-rem (over a 10-year clean-up period). The following equations are applied to these values to calculate monetary equivalents:

Immediate Dose

For a currently operating facility, NUREG/BR-0184 (Ref. 4.20-1, Section 5.7.3) recommends using the following methodology to calculate the immediate dose present value:

$$W_{io} = (F_S D_{io_S} - F_A D_{io_A}) R \frac{1 - e^{-rt_f}}{r} \qquad (3)$$

where:

W_{io} = monetary value of avoided accident risk due to immediate doses (after discounting)

IO = subscript denoting immediate occupational dose

R = monetary equivalent of unit dose, ($/person-rem)

F = accident frequency (events/yr)

D_{io} = immediate occupational dose (person-rem/event)

S = subscript denoting status quo (current conditions)

A = subscript denoting status after implementation of proposed action

r = real discount rate

t_f = years remaining until end of facility life

The values used in the analysis are:

R = $2,000/person rem

r = 0.07

D_{io} = 3,300 person-rem/accident (best estimate)

t_f = 20 years

Assuming F_A (accident frequency) is zero for the base case, the monetary value of the immediate dose associated with the plant accident risk is:

$$W_{io} = (F_s D_{io_s}) R \frac{1 - e^{-rt_f}}{r}$$

$$= 3300 * F * \$2,000 * \frac{1 - e^{-0.07*20}}{0.07}$$

$$= F * (\$6,600,000) * 10.763$$

$$= F * \$0.71E+8, (\$).$$

Long-Term Dose

For a currently operating facility, NUREG/BR-0184 (Ref. 4.20-1, Section 5.7.3) recommends calculating the long-term dose present value using the following equation:

$$W_{LTO} = (F_s D_{LTO_S} - F_A D_{LTO_A}) R * \frac{1 - e^{-rt_f}}{r} * \frac{1 - e^{-m}}{rm} \qquad (4)$$

where:

W_{LTO} = monetary value of accident-risk-avoided long term doses (after discounting)

LTO = subscript denoting long-term occupational doses

m = years over which long-term doses accrue

The values used in the analysis are:

R = $2,000/person rem

r = 0.07

D_{LTO} = 20,000 person-rem/accident (best estimate)

m = "as long as 10 years"

t_f = 20 years

For the base discount rate, assuming F_A is zero, the monetary value of the long-term dose associated with the plant accident risk is:

$$W_{LTO} = (F_s D_{LTO_s}) R * \frac{1 - e^{-rt_f}}{r} * \frac{1 - e^{-rm}}{rm}$$

$$= (F_S \times 20,000) * \$2,000 * \frac{1 - e^{-0.07*20}}{0.07} * \frac{1 - e^{-0.07*10}}{0.07*10}$$

$$= F_S * \$40,000,000 * 10.763(0.719)$$

$$= F_S * \$3.095 \times 10^8$$

4.20.1.4 **Onsite Economic Costs**

Clean-up/Decontamination

The total cost of clean-up and decontamination of a power reactor facility following a severe accident is estimated in NUREG/BR-0184 to be $\$1.5 \times 10^9$; this value is also adopted for these analyses. Considering a 10-year clean-up period, the present value of this cost is:

$$PV_{CD} = \left(\frac{C_{CD}}{m}\right)\left(\frac{1 - e^{-rm}}{r}\right)$$

where:

PV_{CD} = present value of the cost of clean-up/decontamination

CD = subscript denoting clean-up/decontamination

C_{CD} = total cost of the clean-up/decontamination effort, $\$1.5 \times 10^9$

m = clean-up period (10 years)

r = discount rate (7 percent)

Therefore, based on the values previously assumed:

$$PV_{CD} = \left(\frac{\$1.5E+9}{10}\right)\left(\frac{1-e^{-0.07*10}}{0.07}\right)$$

$$PV_{CD} = \$1.07E+9$$

This cost is integrated over the license renewal period as follows:

$$U_{CD} = PV_{CD}\frac{1-e^{-rt_f}}{r}$$

where:

U_{CD} = net present value of clean-up/decontamination over the life of the plant

Based upon the values previously assumed:

$$U_{CD} = (\$1.161E+10)*F$$

Replacement Power Costs

Replacement power costs, U_{RP}, are an additional contributor to onsite costs. These are calculated in accordance with NUREG/BR-0184 (Ref. 4.20-1, Section 5.6.7.2.) Since replacement power will be needed for that time period following a severe accident for the remainder of the expected generating plant life, long-term power replacement calculations have been used. For a "generic" plant of 910 MWe, the present value of replacement power is calculated as follows:

$$PV_{RP} = \left(\frac{1.2E+8}{r}\right)(1-e^{-rt_f})^2$$

where:

PV_{RP} = present value of the cost of replacement power for a single event

t_f = years remaining until end of facility life

r = discount rate

The $\$1.2 \times 10^8$ value has no intrinsic meaning, but is a substitute for a string of non-constant replacement power costs that occur over the lifetime of a "generic" reactor after an event (Ref. 4.20-1, Section 5.7.6). This equation was developed per NUREG/BR-0184 for discount rates between 5 and 10 percent only.

For discount rates between 1 and 5 percent, Ref. 4.20-1 indicates that a linear interpolation is appropriate between present values of $\$1.2 \times 10^9$ at 5 percent and $\$1.6 \times 10^9$ at 1 percent. For discount rates in this range, the following equation was used to perform the linear interpolation.

$$PV_{RP} = (\$1.6E+9) - \left(\frac{[(\$1.6E+9)] - [(\$1.2E+9)]}{[5\% - 1\%]} * [r_s - 1\%]\right)$$

where:

r_s = discount rate (small), between 1 percent and 5 percent

To account for the entire lifetime of the facility, U_{RP} was then calculated from PV_{RP} as follows:

$$U_{rp} = \frac{PV_{RP}}{r}(1 - e^{-rt_f})^2$$

where:

U_{RP} = present value of the cost of replacement power over the life of the facility

Again, this equation is only applicable in the range of discount rates from 5 to 10 percent. NUREG/BR-0184 states that, for lower discount rates, linear interpolations for U_{RP} are recommended between $\$1.9 \times 10^{10}$ at 1 percent and $\$1.2 \times 10^{10}$ at 5 percent. Therefore, for the sensitivity analysis, which considers a 3 percent discount rate, the following equation was used to perform this linear interpolation:

$$U_{RP} = (\$1.9E+10) - \left(\frac{[(\$1.9E+10)] - [(\$1.2E+10)]}{[5\% - 1\%]} * [r_s - 1\%]\right)$$

where:

r_s = discount rate (small), between 1 and 5 percent

MPS2 has a design electrical rating (DER) of 870 MWe. The DER of 870 MWe was used in this calculation, yielding a scaling factor of 0.96 (870/910) to be applied to these formulae. The replacement power cost in Table 4-1 is calculated using this scaling factor.

MPS3 has a design electrical rating (DER) of 1154 MWe. The DER of 1154 MWe was used in this calculation, yielding a scaling factor of 1.268 (1154/910) to be applied to these formulae. The replacement power cost in Table 4-2 is calculated using this scaling factor.

Repair and Refurbishment

Dominion has no plans for major repair/refurbishment following a severe accident; therefore, there is no contribution to averted onsite costs from this source.

Total Onsite Economic Costs

The total averted onsite economic cost is, therefore:

$$AOSC = (U_{CD} + U_{RP})$$

where:

AOSC = averted onsite economic cost

4.20.2 SAMA Identification and Screening

The list of potential enhancements was developed by reviewing industry documents from which reasonable ideas could be gleaned. In addition to the industry sources, plant-specific sources were also reviewed. The plant-specific IPE and IPEEE were examined to determine if there were any additional plant-specific improvements that had not been evaluated in those documents.

The comprehensive set of sources considered in developing the SAMA list is as follows:

- The plant IPE submittal (only items not already evaluated and/or implemented during the IPE) (Ref. 3-1 in the respective Appendices)
- The Watts Bar Nuclear Plant Unit 1 PRA/IPE submittal (Ref. 3-2 in the respective Appendices)
- The Limerick Severe Accident Mitigation Design Alternatives (SAMDA) cost estimate report (Ref. 3-3 in the respective Appendices)
- NUREG-1437 description of Limerick SAMDA (Ref. 3-4 in the respective Appendices)

- NUREG-1437 description of Comanche Peak SAMDA (Ref.3-5 in the respective Appendices)
- Watts Bar SAMDA submittal (Ref. 3-6 in the respective Appendices)
- TVA response to NRC's Request for Additional Information on the Watts Bar SAMDA submittal (Ref. 3-7 in the respective Appendices)
- Westinghouse AP600 SAMDA (Ref. 3-8 in the respective Appendices)
- Safety Assessment Consulting presentation by Wolfgang Werner at the NUREG-1560 conference (Ref. 3-9 in the respective Appendices)
- NRC IPE Workshop - NUREG-1560 NRC Presentation (Ref. 3-10 in the respective Appendices)
- NUREG 0498, Supplement 1, Section 7 (Ref. 3-11 in the respective Appendices)
- NUREG/CR-5567, Pressurized Water Reactor (PWR) Dry Containment Issue Characterization (Ref. 3-12 in the respective Appendices)
- NUREG-1560, Volume 2, NRC Perspectives on the IPE Program (Ref. 3-13 in the respective Appendices)
- NUREG/CR-5630, PWR Dry Containment Parametric Studies (Ref. 3-14 in the respective Appendices)
- NUREG/CR-5575, Quantitative Analysis of Potential Performance Improvements for the Dry PWR Containment (Ref. 3-15 in the respective Appendices)
- CE System 80+ Submittal (Ref. 3-16 in the respective Appendices)
- NUREG-1462, NRC Review of ABB/CE System 80+ Submittal (Ref. 3-17 in the respective Appendices)
- An ICONE paper by C. W. Forsberg, et al., on a core melt source reduction system (Ref. 3-18 in the respective Appendices)
- The plant IPEEE submittal (only those items not already evaluated and/or implemented during the IPEEE) (Ref. 3-19 in the respective Appendices)
- Additional items from the site PRA staff or from review of the most significant Basic Events which were sorted by the Fussell-Vesely parameter
- The Calvert Cliffs Nuclear Power Plant Application for License Renewal (Ref. 3-21 in the respective Appendices)
- The North Anna and Surry Nuclear Power Plant Applications for License Renewal (Ref. 3-22 in the respective Appendices)

MPS2

Although MPS2 is a Combustion Engineering design, all above documents were reviewed for potential SAMAs, even if they were not necessarily applicable to a Combustion Engineering plant. SAMAs not applicable to MPS2 were subsequently removed from the list. The document reviews did not include sections pertaining to containment performance improvement programs for boiling water reactors and ice condenser plants. Conceptual enhancement for which no specific details were available (e.g., "improve diesel reliability" or "improve procedures for loss of support systems") were not adopted as potential SAMAs, unless they were considered as vulnerabilities in the MPS2 IPE.

Table 3-1 in Appendix F lists the 196 potential SAMAs that were identified for consideration. SAMA items 159-196 of this list were obtained from the review of the most significant Basic Events which were sorted by the Fussell-Vesely parameter and the corresponding risk reduction worth (RRW) parameter. Those Basic Events were considered whose Fussell-Vesely parameter was greater than 0.005 or whose RRW parameter was greater than 1.005.

MPS3

Although MPS3 is a Westinghouse design, all above documents were reviewed for potential SAMAs, even if they were not necessarily applicable to a Westinghouse plant. SAMAs not applicable to MPS3 were subsequently removed from the list. The document reviews did not include sections pertaining to containment performance improvement programs for boiling water reactors and ice condenser plants. Conceptual enhancement for which no specific details were available (e.g., "improve diesel reliability" or "improve procedures for loss of support systems") were not adopted as SAMAs, unless they were considered as vulnerabilities in the MPS3 IPE.

Table 3-1 in Appendix G lists the 185 potential SAMAs that were identified for consideration. SAMA items 159-185 of this list were obtained from the review of the most significant Basic Events which were sorted by the Fussell-Vesely parameter and the corresponding Risk Reduction Worth (RRW) parameter. Those Basic Events were considered whose Fussell-Vesely parameter was greater than 0.005 or whose RRW parameter was greater than 1.005.

4.20.2.1 Qualitative Screening of SAMAs

MPS2

The last two columns of Table 3-1 in Appendix F present the qualitative screening of the initial list. Items were eliminated from further evaluation based on one of the following criteria:

- The SAMA was not applicable at MPS2, either because the enhancement was only for boiling water reactors, the Westinghouse AP600 design, or PWR ice condenser containments, or it was a plant-specific enhancement that did not apply at MPS2 (Criterion A); or
- The SAMA had already been implemented at MPS2 (or the MPS2 design meets the intent of the SAMA) (Criterion B), or
- The SAMA was related to a reactor coolant pump (RCP) seal vulnerability at many PWRs, stemming from charging pump dependency on Component Cooling Water (CCW). The MPS2 does not have this vulnerability because the charging pumps are not used for RCP seal injection. MPS2 is a CE design which uses the RBCCW pump to provide RCP seal cooling. (Criterion C).

Based on preliminary screening of 196 SAMAs, 152 were eliminated, leaving 44 subject to the benefit/cost process. The 44 SAMAs left after the initial screening are listed in Table 3-2 in Appendix F. The benefit/cost portion of Table 3-2 is described in Section 4.20.2.2.

MPS3

The last two columns of Table 3-1 in Appendix G present the qualitative screening of the initial list. Items were eliminated from further evaluation based on one of the following criteria:

- The SAMA was not applicable at MPS3, either because the enhancement was only for boiling water reactors, the Westinghouse AP600 design, or PWR ice condenser containments, or it was a plant-specific enhancement that did not apply at MPS3 (Criterion A); or
- The SAMA had already been implemented at MPS3 (or the MPS3 design met the intent of the SAMA) (Criterion B), or
- The SAMA was related to a reactor coolant pump (RCP) seal vulnerability at many PWRs, stemming from charging pump dependency on Component Cooling Water (CCW). MPS3 does not have this vulnerability because the

charging pumps do not rely on CCW. However, other RCP seal loss-of-coolant accident (LOCA) improvements were still considered (Criterion C).

Based on preliminary screening of the 185 SAMAs, 133 improvements were eliminated, leaving 52 subject to the cost/benefit analysis. The 52 SAMAs left after the initial screening are listed in Table 3-2. The benefit/cost portion of Table 3-2 is described in Section 4.20.2.2.

4.20.2.2 Benefit/Cost Analyses

The final screening process involved identifying and eliminating those items whose cost exceeded their benefit.

The SAMA benefit is evaluated in dollar terms by using PRA analysis techniques. This includes Levels 1 and 2 results, using the unit PRA model, and a Level 3 analysis, using the MACCS2 code.

The Level 3 results are determined based on the grouped Level 2 containment release frequencies, and encompass both onsite and offsite consequences. The onsite consequences are proportional to core damage, while the offsite consequences differ for each containment release category. The consequences include a radiation dose term (in person-rem) and a property loss (cost) term in dollars. As described in Section 4.20.1, the dose term is converted to dollars and added to the property losses for both onsite and offsite consequences. The reduction in the total potential cost of an accident by implementing a SAMA constitutes the benefit of that SAMA. This benefit is compared with the estimated cost of implementing the SAMA to determine the overall net value of implementing that SAMA.

The maximum theoretical benefit (also called Maximum Attainable Benefit, or MAB) is based upon the elimination of all plant risk and equates to the previously calculated base case risk. The costs associated with those SAMAs that involve major plant modifications may simply be compared with this benefit as a means of eliminating them from further consideration (e.g., a SAMA that would require construction of a large structure might be compared with the MAB).

Staff experienced in estimating the cost of performing work at a nuclear power plant prepared all the SAMA cost analyses. The depth of analysis performed varied depending on the magnitude of the expected benefit. Detailed cost estimating was performed only in those situations in which the expected benefit is significant. For all other SAMAs, order of magnitude estimates of the hardware modifications were sufficient. To account for uncertainty in the cost estimates,

SAMAs were screened if the cost was at least twice the calculated benefit. Therefore, even if the cost estimates were to vary from the order of magnitude estimate, they would have to differ by at least a factor of two before becoming significant. The factor of two presented in Table 3-2 (MPS2) and G.3-2 (MPS3) provides confidence that even when uncertainties are considered, the conclusions would not change.

Benefit Calculations

For each SAMA evaluation, a revised set of plant damage state frequencies was generated. Using the revised plant damage state frequencies, a revised Level 3 dollars-averted calculation was performed.

The benefit for each evaluation was calculated using the fault trees, event trees, and/or databases in the plant-specific PRA. In addition, each case contains the summary results of the fault tree analysis for the case, in the form of improvement in Core Damage Frequency (CDF) and in offsite release frequency. The results of these benefit calculations are presented in Table 3-2 (MPS2) and G.3-2 (MPS3).

The PRA calculations of SAMA benefit are recognized to have some uncertainty around the mean frequencies used in the analyses. Some of the uncertainty is related to quantifiable uncertainty distributions of the data, while other stems from unquantifiable uncertainty in the PRA assumptions. To account for the possible uncertainty, rather than perform a quantitative uncertainty analysis, several sensitivity analyses on key input information were performed to bound the analysis.

Cost Estimates

The cost estimates were generally made as an order of magnitude approximation. For most of the SAMAs considered, the conservative cost estimates were sufficiently greater than the benefits calculated, such that no additional evaluation was required. The cost estimates were generated by Millstone engineering and corporate financial staff and are presented in Table 3-2 (MPS2) and G.3-2 (MPS3).

The benefits resulting from the bounding estimates presented in the benefit analysis are, in general, rather small. In most cases, the benefits are so small that it is obvious that the implementation costs would exceed the benefits, even without a detailed cost estimate. In many cases, plant staff judgment is applied in assessing whether the benefit approaches the expected implementation costs. Detailed cost estimating is only applied in those situations in which the benefit is significant and application of judgment would be questioned.

4.20.3 Conclusions

MPS2

As shown in Table 3-2 of Appendix F, one of the SAMA analyzed fell within the cost estimate range. In other words, one of the analyzed modifications was in the range of being cost-beneficial: SAMA #3, whose improvement includes enhancing the loss of RBCCW procedure to consider RCS cooldown and depressurization prior to a seal LOCA. The RBCCW provides seal, thermal barrier, upper and lower bearing cooling for the RCP's. Dominion actively participates in a comprehensive industry initiative, in response to NRC Generic Issue 23 (GI-23), "Reactor Coolant Pump Seal Failure." Dominion is following the industry efforts on this issue and will implement the appropriate recommendations resulting from this guidance prior to entering the period of extended operation.

MPS3

As shown in Table 3-2, none of the SAMA analyzed would provide more benefits than it would cost.

4.20.4 Sensitivity Analyses

The PRA calculations supporting this conclusion are recognized to have some uncertainty around the mean frequencies used in the analyses. To account for the possible uncertainty, several sensitivity analyses were performed to bound the analysis. For example, Dominion performed a sensitivity analysis by substituting a 3 percent discount rate for the 7 percent discount rate used for the above analysis, as recommended in Ref. 4.20-1. This reduced discount rate takes into account the additional uncertainties (i.e., interest rate fluctuations) in predicting costs for activities that would take place several years in the future. The results of this and other sensitivity analyses are presented in Appendix F (for MPS2) and Appendix G (for MPS3), and the results hold for the range of variables used in the sensitivity analyses.

Table 4-1.
Millstone Unit 2 Base Case Benefit (in Dollars).[a,b]

Parameter	Value
Offsite annual dose (person-rem)	17.4193
Offsite annual economic cost	$13,707
Offsite exposure cost savings (present dollar value)	$374,964
Offsite economic cost savings (present dollar value)	$147,530
Total offsite cost savings	**$522,494**
Onsite short-term exposure cost (best estimate)	$5,088
Onsite long-term exposure cost (best estimate)	$22,178
Cleanup/decontamination cost savings	$831,690
Total onsite cost savings (without replacement power)	**$858,957**
Replacement power cost	$540,338
Total onsite+offsite cost (with replacement power)	**$1,921,789**
Total cost (onsite+offsite without replacement power)	**$1,381,451**

a. Refer to text in Section 4.20 for discussions of how these numbers are calculated. Benefit calculations are based on a Unit 2 core damage frequency of 7.17×10^{-5}/year.
b. The benefit numbers in this table have not yet been multiplied by 1.3 to account for the External Events contribution. For example, the total onsite and offsite cost savings is $1.92 million, so applying the 1.3 multiplier yields a maximum benefit of $2.5 million for containment/Level 2 improvements.

Table 4-2.
Millstone Unit 3 Base Case Benefit (in Dollars).[a,b]

Parameter	Value
Offsite annual dose (person-rem)	12.8165
Offsite annual economic cost	$21,807
Offsite exposure cost savings (present dollar value)	$275,885
Offsite economic cost savings (present dollar value)	$234,709
Total offsite cost savings	**$510,594**
Onsite short-term exposure cost (best estimate)	$2,046
Onsite long-term exposure cost (best estimate)	$8,918
Cleanup/decontamination cost savings	$334,415
Total onsite cost savings (without replacement power)	**$345,379**
Replacement power cost	$288,626
Total onsite+offsite cost (with replacement power)	**$1,144,599**
Total cost (onsite+offsite without replacement power)	**$855,973**

a. Refer to text in Section 4.20 for discussions of how these numbers are calculated. Benefit calculations are based on a Unit 3 core damage frequency of 2.88×10^{-5}/year.
b. The benefit numbers in this table have not yet been multiplied by 1.6 to account for the External Events contribution. For example, the total onsite and offsite cost savings is $1.15 million, so applying the 1.6 multiplier yields a maximum benefit of $1.8 million for all SAMA.

4.21 References

Ref. 4.0-1 U.S. Nuclear Regulatory Commission. 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants. Volumes 1 and 2. NUREG-1437. Washington, DC. May.

Ref. 4.0-2 U.S. Nuclear Regulatory Commission. 1996. Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." Federal Register. Vol. 61. No. 109. June 5.

Ref. 4.2-1 Northeast Utilities Service Company. 1993. Feasibility Study of Cooling Water System Alternatives to Reduce Winter Flounder Entrainment at Millstone Units 1, 2, and 3. Berlin, CT. January

Ref. 4.2-2 Dominion Nuclear Connecticut, Inc. 2001. An Evaluation of Cooling Water System Alternatives. Millstone Power Station, Waterford, CT. August.

Ref. 4.2-3 Parker, E. C. (CDEP). 1994. Letter to Donald Miller (NNECO). Janaury 14, 1994.

Ref. 4.13-1 American National Standards Institute. 1997. National Electrical Safety Code, ANSI C2-1997, Institute of Electrical and Electronics Engineers, Inc., New York, New York.

Ref. 4.13-2 Corrigan, P. G. (Northeast Utilities). 1990. Letter to Henry Resnikoff (Chase-Resnikoff), Hartford, Connecticut, October 18.

Ref. 4.17-1 Town of Waterford. 1998. 1998 Plan of Preservation, Conservation, and Development.

Ref. 4.19-1 U.S. Nuclear Regulatory Commission. 1984. Final Environmental Statement related to the operation of Millstone Nuclear Power Station Unit No. 3. Docket No. 50-423. NUREG-1064. Washington, DC. December.

Ref. 4.20-1 U.S. Nuclear Regulatory Commission. 1997. "Regulatory Analysis Technical Evaluation Handbook." NUREG/BR-0184. Washington, DC.

Ref. 4.20-2 U.S. Nuclear Regulatory Commission. 1995. "Reassessment of NRC's Dollar Per Person-Rem Conversion Factor Policy." NUREG-1530.

5.0 ASSESSMENT OF NEW AND SIGNIFICANT INFORMATION

5.1 Discussion

NRC

"The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware." 10 CFR 51.53(c)(3)(iv)

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants and provides for license renewal, requiring a license renewal application that includes an environmental report (10 CFR 54.23). NRC regulations, 10 CFR 51, prescribe the environmental report content and identify the specific analyses the applicant must perform. In an effort to streamline the environmental review, NRC has resolved most of the environmental issues generically and only requires an applicant's analysis of the remaining issues.

While NRC regulations do not require an applicant's environmental report to contain analyses of the impacts of those environmental issues that have been generically resolved [10 CFR 51.53(c)(3)(i)], the regulations do require that an applicant identify any new and significant information of which the applicant is aware [10 CFR 51.53(c)(3)(iv)]. The purpose of this requirement is to alert NRC staff to such information, so the staff can determine whether to seek the Commission's approval to waive or suspend application of the rule with respect to the affected generic analysis. NRC has explicitly indicated, however, that an applicant is not required to perform a site-specific validation of Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) conclusions (Ref. 5.1-1).

Dominion Nuclear Connecticut (DNC) expects that new and significant information would include:

- Information that identifies a significant environmental issue not covered in the GEIS and codified in the regulation, or
- Information that was not covered in the GEIS analyses and that leads to an impact finding different from that codified in the regulation.

NRC does not specifically define the term "significant." For the purpose of its review, DNC used guidance available in Council on Environmental Quality (CEQ) regulations. The National Environmental Policy Act authorizes CEQ to establish implementing regulations for federal agency use. NRC requires license renewal applicants to provide NRC with input, in the form of an environmental report, that NRC will use to meet National Environmental Policy Act requirements as they apply to license renewal (10 CFR 51.10). CEQ guidance provides that federal agencies should prepare environmental impact statements for actions that would

significantly affect the environment (40 CFR 1502.3), focus on significant environmental issues (40 CFR 1502.1), and eliminate from detailed study issues that are not significant [40 CFR 1501.7(a)(3)]. The CEQ guidance includes a lengthy definition of "significantly" that requires consideration of the context of the action and the intensity or severity of the impact(s) (40 CFR 1508.27). DNC expects that moderate or large impacts, as defined by NRC, would be significant. Chapter 4.0 presents the NRC definitions of "moderate" and "large" impacts.

DNC implemented an assessment process for new and significant information during preparation of the license renewal application for Millstone Power Station. The process was directed by the License Renewal Project Environmental Lead and included the following actions: (1) interviews with DNC subject experts on information related to the conclusions in the GEIS as they relate to MPS, (2) a review of documents related to environmental issues at MPS, (3) consultations with state and federal agencies to determine if the agencies had concerns not addressed in the GEIS, (4) a review of internal procedures for identifying and reporting to the NRC events that could have environmental impacts, and (5) credit for oversight provided by inspections of plant facilities and environmental monitoring operations by state and federal regulatory agencies.

As a result of this assessment, DNC is aware of no new and significant information regarding the environmental impacts of MPS Units 2 and 3 license renewal.

5.2 References

Ref. 5.1-1 U.S. Nuclear Regulatory Commission. 1996. *Public Comments on the Proposed 10 CFR 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response.* Volumes 1 and 2. NUREG-1529. Washington, DC. May.

6.0 SUMMARY OF LICENSE RENEWAL IMPACTS AND MITIGATING ACTIONS

6.1 License Renewal Impacts

Dominion Nuclear Connecticut (DNC) has reviewed the environmental impacts of renewing the Millstone Power Station (MPS) Units 2 and 3 operating licenses and has concluded that all impacts would be small and would not require mitigation. This environmental report documents the basis for DNC's conclusion. Chapter 4.0 incorporates by reference U.S. Nuclear Regulatory Commission (NRC) findings for the 49 Category 1 issues that apply to MPS, all of which have impacts that are small (Table A-1). The rest of Chapter 4.0 analyzes Category 2 issues, all of which are either not applicable or have impacts that would be small. Table 6-1 identifies the impacts that MPS license renewal would have on resources associated with Category 2 issues.

6.2 Mitigation

NRC

"The report must contain a consideration of alternatives for reducing adverse impacts…for all Category 2 license renewal issues…" 10 CFR 51.53(c)(3)(iii)

"The environmental report shall include an analysis that considers and balances…alternatives available for reducing or avoiding adverse environmental effects." 10 CFR 51.45(c) as incorporated by 10 CFR 51.53(c)(2) and 10 CFR 51.53(c)(3)(iii)

All impacts of license renewal are small and would not require mitigation. Current operations include mitigation and monitoring activities that would continue during the license renewal term. DNC performs routine mitigation and monitoring activities to ensure the safety of workers, the public, and the environment. These activities include the radiological environmental monitoring program, effluent chemistry monitoring, effluent toxicity testing, and monitoring the aquatic communities in Long Island Sound in the vicinity of MPS.

6.3 Unavoidable Adverse Impacts

NRC

The environmental report shall discuss any "[a]dverse environmental effects which cannot be avoided should the proposal be implemented…." 10 CFR 51.45(b)(2) as adopted by 10 CFR 51.53(c)(2)

This environmental report adopts by reference NRC findings for applicable Category 1 issues, including discussions of any unavoidable adverse impacts (Table A-1). DNC examined 21 Category 2 issues and identified the following unavoidable adverse impacts of license renewal:

- Procedures for the disposal of sanitary, chemical, and radioactive wastes are intended to reduce significant adverse impacts from these sources to acceptable levels. A small impact will always be present as long as the plant is in operation. Operating the reactors generates spent nuclear fuel which is stored on site until a permanent geologic repository is available.
- Operation of MPS results in very small increases in radioactivity in the air and water. However, fluctuations in natural background radiation may be expected to exceed the small incremental increase in dose to the local population from the operation of MPS. Operation of MPS also establishes a very low probability risk of accidental radiation exposure to inhabitants of the area.
- Fish are impinged on the traveling screens at the intake structures.
- Larval fish and shellfish are entrained at the intake structures.

6.4 Irreversible and Irretrievable Resource Commitments

NRC

The environmental report shall discuss "[a]ny irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." 10 CFR 51.45(b)(5) as adopted by 10 CFR 51.53(c)(2)

Continued operation of MPS for the license renewal term will result in irreversible and irretrievable resource commitments, including the following:

- nuclear fuel, which is burned in the reactor and converted to radioactive waste;
- land required to dispose of spent nuclear fuel, low-level radioactive wastes generated as a result of plant operations, and sanitary wastes generated from normal industrial operations;
- materials used for the normal industrial operations of the plant that cannot be recovered or recycled or that are consumed or reduced to unrecoverable forms.

6.5 Short-Term Use Versus Long-Term Productivity of the Environment

NRC

The environmental report shall discuss "[t]he relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity." 10 CFR 51.45(b)(4) as adopted by 10 CFR 51.53(c)(2)

The current balance between short-term use and long-term productivity at the MPS site was established when Unit 1 began operating in 1970. The Final Environmental Statement related to the construction of Unit 2 and the operation of Units 1 and 2 (Ref. 6.5-1) evaluated the impacts of constructing and operating MPS at a previously industrial site on Long Island Sound. Unit 3 was constructed later than and adjacent to Unit 2.

Short-term use of natural resources would include land and water. The plant site is an old granite quarry. Much of Millstone Point was disturbed during the quarrying. Approximately 200 acres of the site is devoted to the production of electrical energy. This includes the area occupied by buildings, structures, parking lots and landscaping around the MPS site. Transmission lines add an additional approximately 91 acres that were altered from their former habitat and are now maintained to promote safety along the power lines. While this may have some effect on some species, the open nature of transmission corridors enhances habitat for others. Approximately 30 acres not used for power production has been licensed to the town of Waterford for recreation fields. Approximately 50 acres, including wetlands and a rocky beach front, are maintained for wildlife, including migratory birds. The use of water from Long Island Sound for cooling in the plant does not represent a significant amount of water from a water body that is continually renewed and open to the Atlantic Ocean.

The "trade-off" between the production of electricity and small changes in the local environment is reversible. Experience with other nuclear plants has demonstrated the feasibility of decommissioning and dismantling such plants sufficiently to restore a site to its former use (Ref. 6.5-1, 8-9). The degree of dismantlement, as with most abandoned industrial plants, will take into account the intended new use of the site and a balance among health and safety considerations, salvage values, and environmental impacts. The transmission lines would continue to be used even after MPS ceased operations. Decisions on the ultimate disposition of Millstone Station have not been made. Continued operation for an additional 20 years would not alter this conclusion.

Table 6-1.
Category 2 Environmental Impacts Related to License Renewal at MPS.

No.	Issue	Environmental Impact
	Surface Water Quality, Hydrology, and Use (for all plants)	
13	Water use conflicts (plants with cooling ponds or cooling towers using makeup water from a small river with low flow)	**None.** This issue does not apply because MPS does not use cooling ponds or cooling towers that use makeup water from a small river.
	Aquatic Ecology (for plants with once-through and cooling pond heat dissipation systems)	
25	Entrainment of fish and shellfish in early life stages	**Small.** DNC has a current NPDES permit which constitutes compliance with CWA Section 316(b) requirements to provide best available technology to minimize entrainment.
26	Impingement of fish and shellfish	**Small.** DNC has a current NPDES permit which constitutes compliance with CWA Section 316(b) requirements to provide best available technology to minimize impingement.
27	Heat shock	**Small.** DNC has a CWA Section 316(a) variance for facility-specific thermal discharge limits.
	Groundwater Use and Quality	
33	Groundwater use conflicts (potable and service water, and dewatering; plants that use > 100 gpm)	**None.** This issue does not apply because MPS does not use > 100 gpm of groundwater.
34	Groundwater use conflicts (plants using cooling towers or cooling ponds withdrawing makeup water from a small river)	**None.** This issue does not apply because MPS does not use cooling ponds or cooling towers that use makeup water from a small river.
35	Groundwater use conflicts (Ranney wells)	**None.** This issue does not apply because MPS does not use Ranney wells.
39	Groundwater quality degradation (cooling ponds at inland sites)	**None.** This issue does not apply because MPS does not have cooling ponds at an inland site.
	Terrestrial Resources	
40	Refurbishment impacts	**None**. No impacts are expected because MPS does not plan any refurbishment.

Table 6-1.
Category 2 Environmental Impacts Related to License Renewal at MPS. (Cont.)

No.	Issue	Environmental Impact
	Threatened or Endangered Species	
49	Threatened or endangered species	**Small.** With the exception of seasonal appearances of roseate terns and a limited number of bald eagle sightings there are no known occurrences of federally threatened or endangered species at MPS. DNC has no plans to alter current natural resource management practices and resource agencies contacted by DNC evidenced no concerns.
50	Air quality during refurbishment (non-attainment and maintenance areas)	**None**. No impacts are expected because MPS does not plan any refurbishment.
	Human Health	
57	Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	**None.** This issue does not apply because MPS does not use lakes or canals or cooling towers or ponds that discharge to a small river.
59	Electromagnetic fields, acute effects (electric shock)	**Small.** The transmission lines conform to NESC provisions at the locations of greatest induced-shock probability, the lines would continue to be used regardless of license renewal, and the proposed action has no effect on the current or future status of the lines.
	Socioeconomics	
63	Housing impacts	**Small.** NRC concluded that housing impacts would be small in medium and high population areas having no growth control measures. MPS is located in a high population area that does not have growth limiting measures.
65	Public services: public utilities	**Small.** DNC anticipates no more than five additional employees. An increase of less than 1 percent of the work force is not expected to affect public water supplies.
66	Public services: education (refurbishment)	**None**. No impacts are expected because MPS does not plan any refurbishment.
68	Offsite land use (refurbishment)	**None**. No impacts are expected because MPS does not plan any refurbishment.
69	Offsite land use (license renewal term)	**Small.** Land use patterns in Waterford are very similar to the surrounding towns. Regional land uses are the same as when the plant was constructed.
70	Public services: transportation	**Small.** DNC anticipates no more than five additional employees. An increase of less than 1 percent of the work force is not expected to affect transportation.

Table 6-1.
Category 2 Environmental Impacts Related to License Renewal at MPS. (Cont.)

No.	Issue	Environmental Impact
71	Historic and archeological resources	**Small.** Continued operation of MPS would not require construction at the site or new transmission lines. DNC is not aware of plant-related impacts affecting archeological or historic sites of significance within the area. Therefore, DNC concludes that license renewal would not adversely affect historic or archeological resources.
	Postulated Accidents	
76	Severe accidents	**Small.** DNC identified one beneficial SAMA involving a potential change to a procedure. This issue is being addressed as part of an industry effort.

6.6 References

Ref. 6.5-1 U.S. Atomic Energy Commission. 1973. Final Environmental Statement related to the continuation of construction of unit 2 and the operation of units 1 and 2, Millstone Nuclear Power Station. Docket Nos. 50-245 and 50-336. Directorate of Licensing. June. Washington, DC.

7.0 ALTERNATIVES TO THE PROPOSED ACTION

NRC

The environmental report shall discuss "[A]lternatives to the proposed action." 10 CFR 51.45(b)(3), as adopted by reference at 10 CFR 51.53(c)(2).

"The report is not required to include discussion of need for power or economic costs and benefits of ... alternatives to the proposed action except insofar as such costs and benefits are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation." 10 CFR 51.53(c)(2).

"While many methods are available for generating electricity, and a huge number of combinations or mixes can be assimilated to meet a defined generating requirement, such expansive consideration would be too unwieldy to perform given the purposes of this analysis. Therefore, NRC has determined that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable." (Ref. 7.0-1, Section 8.1).

"The consideration of alternative energy sources in individual license renewal reviews will consider those alternatives that are reasonable for the region, including power purchases from outside the applicant's service area." (Ref. 7.0-2), Section II.H, pg. 66541, column 3).

Chapter 7.0 addresses alternatives to Millstone Power Station (MPS) license renewal. The chapter evaluates what might happen if the U.S. Nuclear Regulatory Commission (NRC) did not renew the Station operating licenses: what alternative actions might be undertaken, which alternatives are not reasonable and why and, for reasonable alternatives, what the associated environmental impacts might be. Chapter 8.0 compares these impacts to those associated with license renewal.

In determining the level of detail and analysis that it should provide in Chapter 7.0, Dominion Nuclear Connecticut (DNC) relied on the NRC decision-making standard for license renewal:

> "…the NRC staff, adjudicatory officers, and Commission shall determine whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable." [10 CFR 51.95(c)(4)].

DNC has determined that the environmental report would support NRC decision making as long as the document provides sufficient information to clearly indicate whether an alternative would have a smaller, comparable, or greater environmental impact than the proposed action. Providing additional detail or analysis serves no function if it only brings to light, for example, additional adverse impacts of alternatives to license renewal. This approach is consistent with regulations of the Council on Environmental Quality, which provide that the consideration of alternatives (including the proposed action) should enable reviewers to evaluate their comparative merits (40 CFR 1500-1508). DNC believes that Chapter 7.0 provides sufficient detail about alternatives to establish

the basis for necessary comparisons to the Chapter 4.0 discussion of impacts from the proposed action.

7.1 No-Action Alternative

7.1.1 Decommissioning

Independent of license renewal decisions, MPS will eventually be decommissioned and DNC must comply with NRC requirements for decommissioning a nuclear power plant.

The Generic Environmental Impact Statement (GEIS) (Ref. 7.0-1, pg. 7-1) defines decommissioning as the safe removal of a nuclear facility from service and the reduction of residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license. NRC-evaluated decommissioning options include immediate decontamination and dismantlement (DECON), and safe storage of the stabilized and defueled facility (SAFSTOR) for a period of time, followed by decontamination and dismantlement. Regardless of the option chosen, decommissioning must be completed within a 60-year period. Under the no-action alternative, DNC would continue operating MPS until the current license expires, then initiate decommissioning activities in accordance with NRC requirements.

The GEIS describes decommissioning activities based on an evaluation of an example reactor (the “reference” pressurized water reactor is the 1,175-megawatts-electric [MWe] Trojan Nuclear Plant). This describes activities comparable to decommissioning activities that DNC would conduct at MPS, and DNC notes that the combined capacity of the two MPS units exceeds the capacity of the single referenced reactor.

As the GEIS notes, NRC has evaluated environmental impacts from decommissioning. NRC-evaluated impacts include occupational and public radiation dose, impacts of waste management, impacts to air and water quality, ecological, economic, and socioeconomic impacts (Ref. 7.1-1). DNC adopts by reference the NRC conclusions regarding environmental impacts of decommissioning.

DNC notes that decommissioning activities and their impacts are not discriminators between the proposed action and the no-action alternative. DNC will have to decommission MPS; license renewal would only postpone decommissioning for 20 years. NRC has established in the GEIS that the timing of decommissioning operations does not substantially influence the environmental impacts of decommissioning. DNC adopts by reference NRC findings (10 CFR 51 Appendix B, Table B-1, Decommissioning) to the extent that delaying decommissioning until after the renewal term would have small environmental impacts. The discriminators between the proposed action and the no-action alternative lie within the choice of options for replacing MPS capacity. Section 7.2.2 analyzes the impacts from these options.

DNC concludes that the decommissioning impacts under the no-action alternative would not be substantially different from those occurring following license renewal, as identified in the

GEIS (Ref. 7.0-1) and in the decommissioning generic environmental impact statement (Ref. 7.1-1, Section 6.0). These impacts would be temporary and would occur at the same time as the impacts from meeting system generating needs.

7.1.2 **Replacement Capacity**

In 2001, MPS provided approximately 15.4 terawatt hours of electricity (Ref. 7.1-2). This is approximately 50.5 percent of the power generated in Connecticut in 2001 (Ref. 7.1-2).

DNC believes that any alternative would be unreasonable if it did not include replacing this capacity. Replacement could be accomplished by (1) building new generating capacity or (2) purchasing power from other sources. In addition, if the region could reduce power requirements through demand reduction, less power would be required to replace current capacity. Section 7.2.1 describes each of these possibilities in detail, and Section 7.2.2 describes environmental impacts from feasible alternatives.

7.2 Alternatives That Meet System Generating Needs

7.2.1 Alternatives Considered

7.2.1.1 Technology Choices

The current mix of power generation options in Connecticut is one indicator of the feasible choices for electric generation technology within the State. DNC evaluated Connecticut electric generation capacity and utilization characteristics. "Capacity" is the quantification of the various installed technology choices. "Utilization" is the degree to which each choice is actually used.

In 2000, Connecticut's electric industry had a total generating capacity of 7,077 MWe (Ref. 7.1-3, Table 3). As Figure 7-1 indicates, this capacity includes nuclear reactors (28.7 percent) and units fueled by oil (13.6 percent), gas (6.4 percent), oil and gas combined (36.2 percent), coal (9.3 percent), hydroelectric (2.2 percent), and other (3.6 percent) (Ref. 7.2-1, Table 4 and Ref. 7.1-3, Table 4).

In 2001 Connecticut's electric industry generated a total of 30.6 terawatt hours[1] of electricity (Ref. 7.1-2). As shown in Figure 7-2, this generation was dominated by nuclear (50.5 percent), followed by oil (19.0 percent), gas (13.6 percent), coal (10.2 percent), other (5.8 percent), and hydroelectric (0.9 percent) (Ref. 7.1-2).

The difference between capacity and utilization is the result of preferential usage. For example, as discussed above, nuclear energy represented 28.7 percent of Connecticut's installed generating capability in 2000, but produced 48.9 percent of the power generated during that year. This reflects Connecticut's electric industry's reliance on nuclear energy as a base-load generating source. This reliance is based on price and reliability.

7.2.1.2 Effects of Deregulation

Efforts to deregulate the electric utility industry began with passage of the National Energy Policy Act of 1992. Provisions of this Act required electric utilities to allow open access to their transmission lines and encouraged development of a competitive wholesale market for electricity. The Act did not mandate competition in the retail market, leaving that decision to the states (Ref. 7.2-2).

In April 1998, the State of Connecticut began the process of restructuring the retail market (i.e., deregulation) by passing Public Act 98-28, "An Act Concerning

1. A terawatt hour (TWh) is one billion kilowatt hours.

Electric Restructuring". The Act required utility companies to divest their generation assets and opened the retail electric supply market to competition (Ref. 7.2-3). As discussed below, this injection of competition among electric generators affects the selection of alternatives for MPS license renewal.

In a deregulated environment, market forces should spur innovation, attract competition, drive the appropriate supply/demand balance, and attract new power suppliers to the State and, thus, benefit the ratepayers. Therefore, suppliers, including the unregulated generation affiliates of the distribution companies in the State of Connecticut, are involved in decisions regarding reasonable alternatives for meeting electrical demands. Decisions on reasonable alternatives are guided, in part, by environmental, economic, and other considerations.

Under deregulation, it is not clear whether DNC or another supplier would construct new generating units to replace those at MPS, if its licenses were not renewed. Regardless of the supplier, however, a new facility would be subject to the same environmental requirements. Therefore, Chapter 7.0 discusses the impacts of reasonable alternatives to MPS license renewal without regard to whether they would be implemented by DNC.

7.2.1.3 Mixture

NRC indicated in the GEIS that, while many methods are available for generating electricity and a huge number of combinations or mixes can be assimilated to meet system needs, such expansive consideration would be too unwieldy given the purposes of the alternatives analysis. Therefore, NRC determined that a reasonable set of alternatives should be limited to analysis of single discrete electrical generation sources and only to those electric generation technologies that are technically reasonable and commercially viable (Ref. 7.0-1, pg. 8-1). Consistent with the NRC determination, DNC has not evaluated mixes of generating sources. Impacts from the technologies presented in Section 7.2.2 of this chapter would bound the impacts from any mixture of reasonable electric power generation alternatives.

7.2.1.4 Fossil-Fuel-Fired Generation

DNC analyzed locating hypothetical new coal-, or gas-fired units at a hypothetical existing site, such as a retired oil-fired plant site. The retirement option has been discussed for several oil plants in Connecticut, and for purposes of this analysis, it is assumed that an existing site of sufficient size is available. Using an existing site could minimize environmental impacts by building on previously disturbed

land and by making the most use possible of existing facilities such as transmission lines, roads and parking areas, office buildings, and the cooling system. Locating hypothetical units at the existing site has, therefore, been applied to the coal- and gas-fired units. It must be emphasized that these are hypothetical scenarios. DNC currently does not own any such sites.

It is also possible that replacement units could be built at MPS. However, the environmental impacts of building coal- or gas-fired units at MPS would not be expected to be less than the impacts projected for construction at a retired oil-fired station. Further, the decommissioning of the nuclear units might delay or complicate the construction of coal- or gas-fired replacements at MPS. Therefore, this variation of the alternative is not considered further.

To facilitate impact analysis, DNC assumed a total capacity of 2,000 MWe for each alternative. Although this provides slightly less capacity than the existing units (2,000 MWe for alternative units versus 2,024 MWe for existing capacity), it ensures against overestimating environmental impacts from the alternatives. The shortfall in capacity could be replaced by other methods, such as importing power. However, for the reasons discussed in Section 7.2.1.3, DNC did not analyze a mixture of these alternatives and imported power.

Although it is difficult to project in advance what pollution control technologies would be required for plants being constructed for operation at the time of Millstone's retirement, conservative assumptions are made concerning these technologies to ensure against over estimating environmental impacts.

Coal-Fired Generation

NRC has evaluated coal-fired generation alternatives in each of the plant-specific Supplements to the GEIS. For the Oconee boiling water reactors, NRC analyzed 2,500 MWe of coal-fired generation capacity (Ref. 7.2-4, Section 8.2.1). DNC has reviewed the NRC analysis, believes it to be sound, and notes that it analyzed more generating capacity than the 2,000 MWe discussed in this analysis. In defining the MPS coal-fired alternative, DNC has used site- and Connecticut-specific input and has scaled from the NRC analysis, where appropriate.

DNC defined the MPS coal-fired alternative as consisting of four 500-MWe units. Table 7-1 describes assumed basic operational characteristics of the coal-fired units. DNC based its emission control technology and percent-control assumptions on alternatives that the U.S. Environmental Protection Agency (EPA) has identified as being available for minimizing emissions (Ref. 7.2-5). For the

purposes of analysis, DNC has assumed that coal and lime (or limestone) would be delivered by rail.

Gas-Fired Generation

DNC has chosen to evaluate gas-fired generation, using combined-cycle turbines, because it has determined that the technology is mature, economical, and feasible. A scenario, for example, of three units with a net capacity of 674 MWe could be assumed to replace the 2,024-MWe MPS total net capacity. However, DNC's experience indicates that, although customized unit sizes can be built, using standardized sizes is more economical. Existing manufacturers' standard-sized units include a gas-fired combined-cycle plant of 400-MWe net capacity, consisting of one 280-MWe gas turbine and 120 MWe of heat recovery capacity (i.e., General Electric STAG 107H, a new, high-efficiency design that is currently available for construction).

DNC assumed five 400-MWe units, having a total capacity of 2,000 MWe, as the gas-fired alternative at the MPS site. Table 7-2 describes assumed basic operational characteristics of the gas-fired units. As for the coal-fired alternative, DNC based its emission control technology and percent-control assumptions on alternatives that the EPA has identified as being available for minimizing emissions (Ref. 7.2-6).

7.2.1.5 Purchased Power

In a traditional alternatives analysis for utility generation capacity, the purchased power alternative meant that the utility would meet a portion of its service area demand using power that it purchased from another utility. Deregulation, however, is changing this traditional analysis. First, the end-user could purchase electricity from another entity (in this case, from a company other than DNC). Second, DNC expects retail competition to decrease generators' incentives to provide wholesale power to competing companies such as DNC for resale, thus reducing the availability of power for DNC to purchase and resell competitively.

DNC has evaluated conventional and prospective power supply options that could be reasonably implemented before the current MPS Units 2 and 3 licenses expire in 2015 and 2025, respectively.

Connecticut relies on a substantial amount of imported electrical power to satisfy its demand. In 1999, Connecticut's net import was 19.2 terawatt-hours of electricity (Ref. 7.2-7, Table 53). Although Connecticut is a net importer of power, DNC assumes that in-state power and additional out-of-state power may be available for purchase. Therefore, DNC has analyzed purchased power as a

reasonable alternative. However, it is not reasonable to assume that the baseload capacity of more than 2,000 MWe provided by MPS could be replaced without the construction of new capacity, particularly in the long run. Indeed there is already considerable demand from adjacent areas, such as Long Island, for increased power from New England. Accordingly, in order to purchase replacement capacity for MPS (2,024 MWe net), new construction would probably be required. DNC assumes that the generating technology used to produce purchased power would be one of those that NRC analyzed in the GEIS. For this reason, DNC is adopting by reference the GEIS description of the alternative generating technologies as representative of the purchased power alternative.

7.2.1.6 **Reduce Demand**

Historically, state regulatory bodies have required regulated utilities to institute programs designed to reduce demand for electricity through energy conservation and load modification measures. With the passage of Public Act 98-28, responsibility for the design and implementation of conservation measures has become the responsibility of regulated electric distribution companies. Public Act 98-28 established a rate schedule for demand-side management (DSM) programs. The distribution companies use revenue from the DSM charges to fund energy conservation and market transformation programs.

Market and regulatory conditions in the deregulated environment can be described as follows:

- A decline in generation costs, due primarily to technological advances that have reduced the cost of constructing new generating units (e.g., combustion turbines);
- National energy legislation, which has encouraged wholesale competition through open access to the generation of electrical energy, as well as state legislation designed to facilitate retail competition.

Consistent with these changes, the electricity generation planning environment features lower capacity and lower energy prices than during earlier periods, shorter planning horizons, lower reserve margins, and increased reliance on market prices to direct resource planning. These have greatly reduced the number of cost-effective DSM alternatives.

Other significant changes include:

- The adoption of increasingly stringent national appliance standards for most major energy-using equipment and the adoption of energy efficiency

requirements in state building codes. These mandates have further reduced the potential for cost-effective generator-sponsored measures.

- In a deregulated environment, DNC would seek to increasingly provide energy services and products in competitive markets at prices that reflect their value to the customer. Market conditions can be expected to continue this shift among providers of cost-effective load management.

For these reasons, DNC determined that the application of DSM programs are not an effective substitute for a large base-load unit operating at high-capacity, such as MPS.

7.2.1.7 Other Alternatives

This section identifies alternatives that DNC has determined are not reasonable and the DNC basis for this determination. DNC accounted for the fact that MPS is a base-load generator and that any feasible alternative to MPS would also need to be able to generate base-load power. In performing this evaluation, DNC relied heavily upon NRC's GEIS (Ref. 7.0-1, Section 8.3).

Oil

Connecticut has 46 oil-fired power plants, some of which can also burn natural gas, comprising approximately 43 percent of the state's capacity (Ref. 7.2-8). In 2001, however, oil-fired units provided just 19 percent of the power generated (Ref. 7.1-2, Table 7). This difference reflects a preference for other fuels to generate baseload electric power.

The historically high price of oil compared to other fuels and the volatility of the crude oil market have prompted a steady decline in the use of oil for electricity generation. From 1990 to 1999 the electric utility oil-fired generating capacity in Connecticut has declined at an average annual rate of 15.2 percent (Ref. 7.2-1, Table 4). In addition, approximately 60 percent of the United States' oil is imported, making it vulnerable to market manipulation by foreign nations (Ref. 7.2-8).

Also, operation of an oil-fired plant would have adverse environmental impacts (including impacts on the aquatic environment and air) that would be similar to those of a coal-fired plant.

DNC has concluded that, due to the volatility of the crude oil market and energy security concerns, oil-fired generation is not a feasible alternative to MPS license renewal.

Wind

Wind power can, in an appropriate location, provide small scale electric generation without the air pollution impacts of fossil plants. Wind power by itself, however, is not suitable for large base-load capacity. As discussed in Section 8.3.1 of the GEIS, wind has a high degree of intermittence, and average annual capacity factors for wind plants are relatively low (less than 30 percent). Wind power, in conjunction with energy storage mechanisms, might serve as a means of providing base-load power. However, current energy storage technologies are too expensive for wind power to serve as a large base-load generator.

According to the Wind Energy Resource Atlas of the United States (Ref. 7.2-9), areas suitable for wind energy applications must be wind power class 3 or higher. Current maps indicate that Connecticut has good wind resources on the shore of Long Island Sound and hilltops in the northern part of the State. However, land-use conflicts such as urban development, farmland, and environmentally sensitive areas minimize the amount of land suitable for wind energy applications (Ref. 7.2-9, Chapter 3).

The GEIS estimates a land use of 150,000 acres per 1,000 MWe for wind power. Therefore, replacement of MPS generating capacity with wind power, even assuming ideal wind conditions, would require dedication of about 475 square miles. This is approximately 10 percent of the total land area in Connecticut and about 600 times the area of MPS. Based on the amount of land needed to replace MPS, the wind alternative would require large greenfield sites along the coastline and mountains, which would result in a large environmental impact. Additionally, wind plants have aesthetic impacts, generate noise, and harm birds.

DNC has concluded that, due to the limited availability of land in Connecticut with suitable wind speeds and the amount of land needed (approximately 475 square miles), wind power is not a reasonable alternative to MPS license renewal.

Solar

Solar power can provide small scale electric generation without the air pollution impacts of fossil plants. By its nature, however, solar power is intermittent. In conjunction with energy storage mechanisms, solar power might serve as a means of providing base-load power. However, current energy storage technologies are too expensive to permit solar power to serve as a large base-load generator. Even without storage capacity, solar power technologies (photovoltaic and thermal) cannot currently compete with conventional

fossil-fueled technologies in grid-connected applications, due to high costs per kilowatt of capacity (Ref. 7.0-1, Sections 8.3.2 and 8.3.3).

Solar power is not a technically feasible alternative in DNC's service area. The State of Connecticut receives between 3 and 3.5 kilowatt hours per square meter per day (Ref. 7.2-10) compared with 5.5 to 7.0 kilowatt hours per square meter per day in areas of the West, such as California, which are most promising for solar technologies (Ref. 7.0-1, Sections 8.3.2 and 8.3.3).

Finally, according to the GEIS, land requirements for solar plants are high, at 35,000 acres per 1,000 MWe for photovoltaic and 14,000 acres per 1,000 MWe for solar thermal systems. Therefore, replacement of MPS generating capacity with solar power would require dedication of about 110 square miles for photovoltaic and 45 square miles for solar thermal systems. Neither type of solar electric system would fit at the approximately 0.8 square mile MPS site, and both would have large environmental impacts at a greenfield site.

DNC has concluded that, due to the high cost, limited availability of sufficient incident solar radiation, and amount of land needed (approximately 45 to 110 square miles), solar power is not a reasonable alternative to MPS license renewal.

Hydropower

Hydroelectric generating capability in Connecticut is approximately 156 MW (2.2 percent of the State's total industry capacity), and utilization is only 0.3 to 0.4 terawatt hours per year (0.9 to 1.3 percent of the State's total industry utilization). This minimal utilization and capacity of hydropower indicates a preference for other base-load sources of energy. As the GEIS points out in Section 8.3.4, hydropower's percentage of United States generating capacity is expected to decline because hydroelectric facilities have become difficult to site as a result of public concern over flooding, destruction of natural habitat, and destruction of natural river courses. According to the U.S. Hydropower Resource Assessment (Ref. 7.2-11), for Connecticut, the modeled capacity of undeveloped sites in Connecticut is 43.5 MWe, 2.1 percent of that needed to replace MPS.

The GEIS (Section 8.3.4) estimates land use of 1,600 square miles per 1,000 MWe for hydroelectric power. Based on this estimate, replacement of MPS generating capacity would require flooding approximately 3,200 square miles. If such capacity were available, development would result in a large impact on land use. Further, operation of a hydroelectric facility would alter aquatic habitats above and below the dam, which would impact existing aquatic species.

DNC has concluded that, due to the lack of suitable sites in Connecticut and the amount of land needed (approximately 3,200 square miles or two-thirds of the state), hydropower is not a reasonable alternative to MPS license renewal.

Geothermal

As illustrated by Figure 8.4 in the GEIS, geothermal plants might be located in the western continental United States, Alaska, and Hawaii, where hydrothermal reservoirs are prevalent. However, because there are no high-temperature geothermal sites in Connecticut, DNC concludes that geothermal is not a reasonable alternative to MPS license renewal.

Wood Energy

Fuel wood can be found in Connecticut in the form of waste from forestry operations. Additional supplies exist in residues from the state's wood product industries and from urban sources. The U.S. Department of Energy (DOE) estimates that the total amount of wood residue available for energy uses in Connecticut is approximately 707,000 dry tons per year (Ref. 7.2-12). The National Renewable Energy Laboratory estimates that one dry ton of wood residue can produce 1,100-kWh of electricity (Ref. 7.2-13). Therefore, wood residues could be used to generate an estimated 0.8 terawatt hours of electricity in Connecticut. This is approximately 4.9 percent of the power generated by MPS in 2000.

Further, as discussed in Section 8.3.6 of the GEIS, construction of a wood-fired plant would have an environmental impact that would be similar to that for a coal-fired plant, although facilities using wood waste for fuel would be built on smaller scales. Like coal-fired plants, wood-waste plants require large areas for fuel storage, processing, and waste disposal (i.e., ash). Wood is difficult to handle and expensive to transport. Additionally, operation of wood-fired plants has environmental impacts, including impacts on the aquatic environment and air.

DNC has concluded that, due to the lack of significant wood residue resources in Connecticut, the lack of an obvious environmental advantage, handling difficulties, high transportation costs, and the large impact on land use, wood energy is not a reasonable alternative to MPS license renewal.

Municipal Solid Waste

As discussed in Section 8.3.7 of the GEIS, the initial capital costs for municipal solid waste plants are greater than for comparable steam turbine technology at wood-waste facilities. This is due to the need for specialized waste separation and handling equipment.

The decision to burn municipal solid waste to generate energy is usually driven by the need for an alternative to landfills, rather than by energy considerations. The use of landfills as a waste disposal option is likely to increase in the near term; however, it is unlikely that many landfills will begin converting waste to energy because of unfavorable economics, particularly with electricity prices declining.

Estimates in the GEIS suggest that the overall level of construction impacts from a waste-fired plant should be approximately the same as that for a coal-fired plant. Additionally, waste-fired plants have the same or greater operational impacts (including impacts on the aquatic environment, air, and waste disposal). Some of these impacts would be moderate, but still larger than the environmental effects of MPS license renewal.

DNC has concluded that, due to the high costs and lack of obvious environmental advantages, burning municipal solid waste to generate electricity is not a reasonable alternative to MPS license renewal.

Other Biomass-Derived Fuels

In addition to wood and municipal solid waste fuels, there are several other concepts for fueling electric generators, including burning energy crops, converting crops to a liquid fuel such as ethanol (ethanol is primarily used as a gasoline additive), and gasifying energy crops (including wood waste). As discussed in Section 8.3.8 of the GEIS, none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a base-load plant such as MPS.

DOE estimates that energy crops in Connecticut could produce approximately 200,000 dry tons per year (Ref. 7.2-12). This equates to approximately 0.2 terawatt hours of electricity, which is approximately 1.3 percent of the power generated by MPS in 2000.

Further, estimates in the GEIS suggest that the overall level of construction impacts from a crop-fired plant should be approximately the same as that for a wood-fired plant. Crop-fired plants also would have similar operational impacts (including impacts on the aquatic environment and air). In addition, a recent study estimated that approximately 130,000 acres of wood crops would be required to support a 150-MW wood energy facility (Ref. 7.2-14). Based on this estimate, replacement of MPS generating capacity would require dedication of about 2,750 square miles to wood energy crops. This would result in a large impact on land use.

DNC has concluded that, due to the high costs, lack of obvious environmental advantage, and the large impact on land use, burning other biomass-derived fuels is not a reasonable alternative to MPS license renewal.

Fuel Cells

Currently there are three main types of fuel cells being developed for commercial electric generation: phosphoric acid, molten carbonate, and solid oxide. Phosphoric acid fuel cells are the most mature technology, having been installed in over 200 systems worldwide. However, just 75 MW of stationary fuel cell electricity generating capacity has been installed, globally (Ref. 7.2-15). The largest fuel cell system is an 11 MW phosphoric acid unit (Ref. 7.2-16).

DOE estimates suggest that a company would have to produce about 100 MW of fuel cell stacks annually to achieve a competitive price of $1,000 to $1,500 per kilowatt (Ref. 7.2-17).

DNC believes that this technology has not matured sufficiently to support production for a facility the size of MPS. DNC has concluded that, due to the cost and production limitations, fuel-cell technology is not a reasonable alternative to MPS license renewal.

Delayed Retirement

DNC does not own plants other than MPS in the Connecticut marketing area. Fossil plants slated for retirement tend to be ones that are old enough to have difficulty in meeting today's restrictions on air contaminant emissions. In the face of increasingly stringent air emission restrictions, delaying retirement in order to compensate for a plant the size of MPS would appear to be unreasonable. It would force major construction to retrofit emission control devices, upgrade or replace plant components, and contend with large transmission requirements to transfer the electricity to the Connecticut marketing area. DNC concludes that the environmental impacts of such a scenario are more severe than importing power or providing coal-, gas-, or oil-fired units on an existing site.

7.2.2 Environmental Impacts of Alternatives

This section evaluates the environmental impacts from what DNC has determined to be reasonable alternatives to MPS license renewal: coal-, and gas-fired generation and purchased power.

In characterizing environmental impacts from alternatives, DNC has used the same definitions of "small," "moderate," and "large" that are presented in the Chapter 4.0 Introduction.

7.2.2.1 Coal-Fired Generation

NRC evaluated environmental impacts from coal-fired generation alternatives in the GEIS (Ref. 7.0-1, Section 8.3.9) and concluded that construction impacts could be substantial, due in part to the large land area required (which can result in natural habitat loss) and the large workforce needed. NRC pointed out that siting a new coal-fired plant where an existing nuclear plant is located would reduce many construction impacts. NRC identified major adverse impacts from operations as human health concerns associated with air emissions, waste generation, and losses of aquatic biota due to cooling water withdrawals and discharges.

The coal-fired alternative defined by DNC in Section 7.2.1.4 would be located at a hypothetical existing site such as a retired oil-fired facility.

Air Quality

Air quality impacts of coal-fired generation are considerably different from those of nuclear power. A coal-fired plant would emit sulfur dioxide (SO_2 as SO_x surrogate), nitrogen oxides (NO_x), particulate matter (PM), and carbon monoxide (CO), all of which are criteria pollutants.

As discussed later in this section, regulations following the Clean Air Act Amendments of 1990 established programs which require new power plants to offset their emissions of both NO_x and SO_x through the purchase of NO_x and SO_x allowances. This system ensures that emissions from new power plants will be offset by the elimination of emissions elsewhere, resulting in cleaner air. Although this program has been effective in cleaning the nation's air, the availability of such allowances in the future is highly uncertain. In fact, the construction of such a large facility could require the retirement of significant existing fossil power plants to create sufficient allowances for the facility to operate. This, in turn, would require the construction of additional replacement power capacity. For the purpose of this analysis, however, the assumption is made that allowances are available for use at the facility.

Numerous emission reduction technologies are available for coal-fired power plants, each with its own advantages and disadvantages. An analysis of current (pulverized coal) technology—with the post-combustion pollution controls described in the bullets below—is included, as it is the cleanest economically viable technology available today.

It is noteworthy that of the 63,000 MW's of new coal based generation currently under development and projected in the United States, none of this is located in

Connecticut, or in New England. This region of the Country has little or no incentive to promote coal as a fuel of choice for electric generation.

In terms of environmental impacts, Connecticut may very well present strong opposition to any form of coal based electric generation. Additionally, Connecticut legislation passed in 2003 requires a 90 percent reduction in mercury emissions from coal-fired power plants in the state. The legislation is the first by any state in the nation to require mercury emissions reductions from power plants by a date certain. The law requires coal-fired power plants in Connecticut to achieve an emissions standard of 0.6 pounds of mercury per trillion Btu or a 90 percent efficiency rate in technology installed to control mercury emissions. The emissions limits go into effect in July 2008.

Development and deployment of advanced coal based technologies such as Integrated Gasification Combined Cycle (IGCC) or Ultrasupercritical (USC) units for electricity generation could minimize environmental impacts. Although these options would not be economically viable at this time, they may be in the future. Even with the application of maximum environmental control technology, however, emission offsets and credits would still be needed to permit such a project.

Integrated Gasification Combined Cycle (IGCC) power plant technology employs a series of processes to achieve high efficiencies and ultra low emission levels. Coal (or petroleum coke) is partially combusted in a gasifier process to generate a clean gaseous fuel, which is then used in an advanced Combined Cycle Combustion Turbine power plant application. The environmental result is SO_2 and NO_x emission rates well below that achievable with conventional coal fired boilers with back end controls. SO_2 and NO_x rates of 0.05 lb/MMBtu could be expected. Particulate emission rates of 0.005 lb/MMBtu could be expected and mercury emissions minimal.

Ultrasupercritical (USC) steam power plant technology combines ultra high pressure with ultra high temperature steam cycles to achieve maximum electric generation efficiencies. USC technology is projected to be about 2 percent more efficient than conventional supercritical (high pressure-high temperature) technology and about 7 percent more efficient than today's subcritical (standard pressure-standard temperature) units. Such efficiencies will yield proportionate reductions in all emissions including CO_2. Given that coal combustion is the primary source of heat in a USC unit, Best Available Control Technology (BACT) and Lowest Achievable Emission Rate (LAER) regulatory requirements would be applicable. Therefore, maximum emission control technologies would need to be employed with a USC unit just as they would be require for a conventional coal

fired unit. Note that USC units have not been commercially demonstrated in the United States although they have been under development and recently operating overseas.

For purposes of this analysis, DNC has assumed that the following combination of boiler technology and post-combustion pollutant removal will be commensurate with the environmental requirements at the time of construction:

- NO_x controls would be low NO_x burners, overfire air and selective catalytic reduction (85 to 95 percent reduction)
- particulate controls would be fabric filters (baghouse with 99.9 percent removal efficiency)
- SO_x controls would be wet scrubber-lime (80 to 95 percent removal efficiency)

DNC estimates the coal-fired alternative emissions to be as follows:

SO_x = 3,445 to 13,780 tons per year

NO_x = 1,486 to 4,459 tons per year

CO = 1,486 tons per year

CO_2 = 16,379,473 tons per year

PM:

PM = 144 tons per year

Filterable PM_{10} (particulates having a diameter of less than 10 microns) = 33 tons per year

Table 7-3 shows how DNC calculated these emissions.

Coal combustion also results in low emissions of heavy metals such as mercury, and hazardous air pollutants such as benzene, polychlorinated dibenzo-p-dioxins, and polychlorinated dibenzofurans.

In 1999, emissions of SO_2 and NO_x from Connecticut generators ranked 40th and 41st nationally, respectively (Ref. 7.2-1). No Connecticut generators were cited in the Clean Air Act Amendments of 1990 to begin compliance in 1995 with stricter emission controls for SO_2 and NO_x. The acid rain requirements of the Clean Air Act Amendments capped the nation's SO_2 emissions from power plants. Subsequently, the Governor of Connecticut issued Executive Order 19, which imposed stringent emission reductions of SO_2 and NO_x on large emission units, including all fossil-fuel-fired power plants. Companies having fossil-fuel-fired units were allocated SO_2 allowances. To be in compliance, the companies must hold

enough allowances to cover their annual SO_2 emissions (Ref. 7.2-18). DNC, with no fossil-fired-units in Connecticut, would have to purchase allowances on the open market to operate a fossil-fuel-burning plant in the state.

On September 24, 1998, EPA promulgated the NO_x State Implementation Plan Call (commonly known as the NO_x SIP Call) regulation that requires the District of Columbia and 22 states, including Connecticut, to submit SIPs to prohibit specified amounts of emissions of NO_x (Ref. 7.2-19).

The regulation imposes an NO_x "budget" to limit the NO_x emissions from each state. Beginning in 2003, each electrical generating unit must hold enough NO_x credits to cover its annual NO_x emissions. As with SO_2 allowances, a new fossil-fuel burning plant would have to acquire such credits. Connecticut submitted a revised SIP on October 15, 2001, and committed to a mid-course review submittal date of December 31, 2004 (Ref. 7.2-20).

NRC did not quantify coal-fired emissions in the GEIS, but implied that air impacts would be substantial. NRC noted that public health risks have been associated with coal combustion and that adverse human health effects from coal combustion have led to important federal legislation in recent years. NRC also mentioned global warming and acid rain as potential impacts. SO_2 emission allowances, NO_x emission offsets, low NO_x burners, overfire air, fabric filters or electrostatic precipitators, and scrubbers are regulatorily imposed mitigation measures. Therefore, DNC concludes that the coal-fired alternative would have moderate impacts on air quality, but would not destabilize air quality in the area.

Waste Management

DNC concurs with the GEIS assessment that the coal-fired alternative would generate substantial solid waste. The coal-fired plant, using coal with an ash content of 4.85 percent, would annually consume approximately 5.9 million tons of coal (Table 7-3). Particulate control equipment would collect most (99.9 percent) of the ash, approximately 290,000 tons per year. SO_x-control equipment, annually using nearly 64,000 tons of calcium oxide (lime), would generate another 188,000 tons per year of waste in the form of scrubber sludge. DNC estimates ash and scrubber waste disposal over a 40-year plant life. While only half this waste volume and land use would be attributable to the 20-year license renewal period alternative, the total numbers are pertinent as a cumulative impact. Table 7-4 shows how DNC calculated ash and scrubber waste volumes.

DNC believes that, with proper siting coupled with current waste management and monitoring practices, waste disposal would not destabilize any resources. It is

assumed for this analysis that there would be space within the site boundary for this disposal. After closure of the waste site and revegetation, the land would be available for other uses. For these reasons, DNC believes that waste disposal for the coal-fired alternative would have moderate impacts; the impacts of increased waste disposal would be clearly noticeable, but would not destabilize any important resource and further mitigation would be unwarranted.

Other Impacts

Construction of the powerblock and coal storage area would impact approximately 300 acres of land and associated terrestrial habitat. Because most of this construction would be in previously disturbed areas, impacts would be minimal. Visual impacts would be consistent with the industrial nature of the site. As with any large construction project, some erosion and sedimentation and fugitive dust emissions could be anticipated, but would be minimized by using best management practices.

Connecticut has implemented a statewide mandatory source reduction and recycling program. Under this program debris from clearing and grubbing could be recycled or disposed of onsite. Other construction wastes would be sorted and processed at volume reduction facilities for reuse and recycling. Markets for the reuse of salvaged material and materials with recycled content are expected to grow substantially over the next 20 years. Therefore impacts on land use would be small.

Socioeconomic impacts from the construction workforce would be minimal because worker relocation would not be expected, due to the dense population within 50 miles of any site in the state. Socioeconomic impacts would result from the decrease in operational workforce from approximately 1,550-1,650 employees and long-term contractors at MPS to approximately 400 for the coal-fired station. DNC believes that these impacts would be small, due to the mitigating influence of any Connecticut site's proximity to major population centers. Cultural resource impacts would be unlikely, due to the previously disturbed nature of the site, but could be mitigated by survey and recovery techniques.

Impacts to aquatic resources and water quality would be minimized by any water system design changes necessary to comply with Section 316(b) of the Clean Water Act. The new stacks, boilers, and rail deliveries would be an incremental addition to the visual impact from existing site structures and operations. Coal delivery would add noise and transportation impacts associated with unit-train traffic. DNC believes that other construction and operation impacts would be small. In most cases, the impacts would be detectable, but they would not

destabilize any important attribute of the resource involved. Due to the minor nature of these impacts, mitigation would not be warranted beyond that mentioned.

7.2.2.2 Gas-Fired Generation

NRC evaluated environmental impacts from gas-fired generation alternatives in the GEIS, focusing on combined-cycle plants. Section 7.2.1.4 presents DNC's reasons for defining the gas-fired generation alternative as a combined-cycle plant on a hypothetical existing site, such as a retired oil-fired plant site. Land-use impacts from gas-fired units on the site would be less than those of the coal-fired alternative. Reduced land requirements, due to construction on the existing site and a smaller facility footprint, would reduce impacts to ecological, aesthetic, and cultural resources as well. As discussed under "Other Impacts", a smaller workforce could have adverse socioeconomic impacts. Human health effects associated with air emissions would be of concern. Aquatic biota losses due to cooling water withdrawals would be similar to the impacts previously incurred by operation of the oil-fired generators. Because the heat input for the gas-fired alternative is less than that of the coal fired alternative (5,690 vs. 10,200 Btu per kWh), less cooling water would be required for the gas-fired alternative.

Air Quality

Natural gas is a relatively clean-burning fossil fuel. Further, because the heat recovery steam generator does not receive supplemental fuel, the combined-cycle operation is highly efficient (an assumed 60 percent vs. 33 percent for the coal-fired alternative). Therefore, the gas-fired alternative would release similar types of emissions to the air, but in lesser quantities than the coal-fired alternative. Nonetheless, the same NO_X and SO_X offset issues discussed in Section 7.2.2.1 would need to be addressed. Control technology for gas-fired turbines focuses on

NO_x emissions. Specifically, DNC assumes the following technologies would be commensurate with the environmental requirements at the time of construction:

- NO_x controls would be selective catalytic reduction

DNC estimates the gas-fired alternative emissions to be as follows:

- SO_x = 150 tons per year
- NO_x = 564 tons per year
- CO = 740 tons per year
- CO_2 = 4,846,869 tons per year
- Filterable PM = 220 tons per year (all particulates are PM_{10})

Table 7-5 shows how DNC calculated these emissions.

The Section 7.2.2.1 discussion of regional air quality, Clean Air Act requirements, and the NO_x State Implementation Plan Call is also applicable to the gas-fired generation alternative. NO_x effects on ozone levels, SO_2 allowances, and NO_x emission offsets could all be issues of concern for gas-fired combustion. While gas-fired turbine emissions are less than coal-fired boiler emissions, and regulatory requirements are less stringent, the emissions are still substantial. DNC concludes that emissions from a gas-fired alternative located in Connecticut would alter local air quality, but would not destabilize regional resources. Air quality impacts would therefore be moderate, but smaller than those of coal-fired generation.

Waste Management

Gas-fired generation would result in almost no waste generation, producing minor (if any) impacts. DNC concludes that gas-fired generation waste management impacts would be small.

Other Impacts

As with the coal-fired alternative, the ability to construct the gas-fired alternative on an existing power plant site would reduce construction-related impacts.

To the extent practicable, the pipeline would be routed along previously disturbed rights-of-way to minimize impacts. However, this would still be a costly (i.e., approximately $1 million/mile) and potentially controversial action with ecological impacts from installation of a buried 16-inch gas pipeline to the site. DNC does not expect that installation of a pipeline would create a long-term reduction in the local or regional diversity of plants and animals.

NRC estimated in the GEIS that 110 acres would be needed for a plant site; this much previously disturbed acreage would be available at a retired oil-plant site, reducing loss of terrestrial habitat. Aesthetic impacts, erosion and sedimentation, fugitive dust, and construction debris impacts would be similar to the coal-fired alternative, but smaller because of the reduced site size. Socioeconomic impacts of construction would be minimal. However, the GEIS estimates a work force of 150 for gas operations. DNC would expect this number to be closer to 40-55 (Ref. 7.2-21) workers for a plant of this size. This reduction in the current work force would result in adverse socioeconomic impacts. DNC believes these impacts would be small and would be mitigated by the site's proximity to Connecticut population centers.

7.2.2.3 **Purchased Power**

As discussed in Section 7.2.1.5, DNC assumes that the generating technology used under the purchased power alternative would be one of those that NRC analyzed in the GEIS. DNC is adopting by reference the NRC analysis of these alternatives. Environmental impacts would occur, but would be located elsewhere. For the purposes of analysis, DNC assumes that the new unit would be built at a remote location in Connecticut. However, because Connecticut is a net importer of electricity, DNC realizes that an in-state vendor is likely to prefer to use the new capacity to reduce imports to its service area. The purchased power alternative would include constructing up to 400 miles of high-voltage (e.g., 345- or 500-kV) transmission lines. DNC believes most of the transmission lines could be routed along existing rights-of-way and assumes that the environmental impacts of transmission line construction would be moderate. As indicated in the introduction to Section 7.2.1.4, the environmental impacts of construction and operation of new coal- or gas-fired generating capacity for purchased power at a previously undisturbed greenfield site would exceed those of a coal- or gas-fired alternative located on an existing power plant site.

Table 7-1.
Coal-Fired Alternative.

Characteristic	Basis
Unit size = 500 MW ISO rating net[a]	Set to match capacity of gas-fired alternative
Unit size = 530 MW ISO rating gross[a]	Calculated based on 6 percent onsite power
Number of units = 4	Provides 24 MW less than MPS Units 2 & 3 total net capacity of 2,024 MW
Boiler type = tangentially fired, dry-bottom	Minimizes nitrogen oxides emissions (Ref. 7.2-25, Table 1.1-3).
Heat rate = 10,200 Btu/kWh	Typical for coal-fired single-cycle steam turbines (Ref. 7.2-22, pg. 108)
Capacity factor = 0.85	Assumed.
Fuel type = bituminous, pulverized coal	Typical for coal used in Connecticut
Fuel heating value = 13,541 Btu/lb	1999 value for coal used in Connecticut (Ref. 7.2-23, Table 106).
Fuel ash content by weight = 4.85 percent	1999 value for coal used in Connecticut (Ref. 7.2-23, Table 106).
Fuel sulfur content by weight = 0.61 percent	1999 value for coal used in Connecticut (Ref. 7.2-23, Table 106).
Uncontrolled SO_x emission = 38S =23.18 lb/ton Uncontrolled NO_x emission = 10 lb/ton Uncontrolled CO emission = 0.5 lb/ton	Typical for pulverized coal, tangentially fired, dry-bottom, NSPS (Ref. 7.2-5, Table 1.1-3).
Uncontrolled PM = 10 A = 48.5 lb/ton Uncontrolled PM_{10} = 2.3A = 11.16 lb/ton	Typical for pulverized coal, tangentially fir ed, dry-bottom (Ref. 7.2-5, Table 1.1-4).
Uncontrolled CO_2 emission = 5510 lb/ton	Typical for high-volatile bituminous coal (Ref. 7.2-5, Table 1.1-20).
NO_x control = low NO_x burners, overfire air and selective catalytic reduction (85 to 95 percent reduction)	Best available and widely demonstrated for minimizing NO_x emissions (Ref. 7.2-5, Table 1.1-2).
Particulate control = fabric filters (baghouse-99.9 percent removal efficiency)	Best available for minimizing particulate emissions (Ref. 7.2-5, pp. 1.1-6 and -7)
SO_x control = Wet scrubber – lime (80 to 95 percent removal efficiency)	Best available for minimizing SO_x emissions (Ref. 7.2-5, Table 1.1-1)

Btu = British thermal unit
CO = carbon monoxide
CO_2 = carbon dioxide
ISO rating = International Standards Organization rating at standard atmospheric conditions of 59ºF, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
kWh = kilowatt-hour
lb = pound
MW = megawatt
NO_x = nitrogen oxides
NSPS = new source performance standards
PM = particulate matter
PM_{10} = particulate matter nominally less than 10 microns diameter
SO_x = sulfur oxides

a. The difference between “net” and “gross” is electricity consumed onsite.

Table 7-2.
Gas-Fired Alternative.

Characteristic	Basis
Unit size = 400 MW ISO rating net[a] One 280-MW combustion turbine and a 120-MW heat recovery boiler	Manufacturer's standard size gas-fired combined cycle plant
Unit size = 416-MW ISO rating gross[a]	Calculated based on 4 percent onsite power
Number of units = 5	Provides 24 MWe less than MPS Units 2 & 3 net capacity of 2,024 MWe
Heat rate = 5,690 Btu/kWh	Manufacturer's listed heat rate for this unit.
Capacity factor = 0.85	Typical for large gas-fired base load units
Fuel type = natural gas	Assumed
Fuel heating value = 1,028 Btu/ft^3	1999 value for natural gas used in Connecticut (Ref. 7.2-22, Table 28)
Fuel sulfur content in percent = S = NA	See basis for uncontrolled SO_x emission when sulfur is not available.
NO_x control = selective catalytic reduction (SCR)	Best available for minimizing NO_x emissions (Ref. 7.2-24)
Uncontrolled SO_x emission = 0.0034 lb/MMBtu	0.94S, use 0.0034 lb/MMBtu when sulfur content is not available (Ref. 7.2-24, Table 3.1.2a)
Fuel NO_x content = 0.0128 lb/MMBtu	Typical for large SCR-controlled gas fired units (Ref. 7.2-24)
Fuel CO content = 0.0168 lb/MMBtu	Typical for large SCR-controlled gas fired units (Ref. 7.2-24)
Uncontrolled CO_2 emission = 110 lb/MMBtu	Typical for large SCR-controlled gas fired units (Ref. 7.2-24, Table 3.1.2a)
Uncontrolled Filterable PM and PM_{10} emission = 0.0050 lb/MMBtu	Typical for large gas-fired units (Ref. 7.2-6)

NA = Not available
Btu = British thermal unit
CO = carbon monoxide
CO_2 = carbon dioxide
ft_3 = cubic foot
ISO rating = International Standards Organization rating at standard atmospheric conditions of 59ºF, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
kWh = kilowatt hour
lb = pound
MM = million
MW = megawatt
NO_x = nitrogen oxides
PM = particulate matter
PM_{10} = particulate matter nominally less than 10 microns diameter
SO_x = sulfur oxides
SCR = selective catalytic reduction

a. The difference between "net" and "gross" is electricity consumed onsite.

Table 7-3.
Air Emissions from Coal-Fired Alternative.

Parameter	Calculation	Result
Annual coal consumption	$4\text{ units} \times \frac{530\text{ MW}}{\text{unit}} \times \frac{10,200\text{ Btu}}{\text{kWxhr}} \times \frac{1,000\text{ kW}}{\text{MW}} \times \frac{\text{lb}}{13,541\text{ Btu}} \times \frac{\text{ton}}{2,000\text{ lb}} \times 0.85 \times \frac{24\text{ hr}}{\text{day}} \times \frac{365\text{ day}}{\text{yr}}$	5,945,362 tons of coal per year
SO_x[a,c]	$\frac{38 \times 0.61\text{ lb}}{\text{ton}} \times \frac{\text{ton}}{2,000\text{ lb}} \times \frac{(100-95)}{100} \times \frac{5,945,362\text{ tons}}{\text{yr}}$	3,445 tons SO_x per year
SO_x[a,c]	$\frac{38 \times 0.61\text{ lb}}{\text{ton}} \times \frac{\text{ton}}{2,000\text{ lb}} \times \frac{(100-80)}{100} \times \frac{5,945,362\text{ tons}}{\text{yr}}$	13,781 tons SO_x per year
NO_x[b,c]	$\frac{10\text{ lb}}{\text{ton}} \times \frac{\text{ton}}{2,000\text{ lb}} \times \frac{(100-95)}{100} \times \frac{5,945,362\text{ tons}}{\text{yr}}$	1,486 tons SO_x per year
NO_x[b,c]	$\frac{10\text{ lb}}{\text{ton}} \times \frac{\text{ton}}{2,000\text{ lb}} \times \frac{(100-85)}{100} \times \frac{5,945,362\text{ tons}}{\text{yr}}$	4,459 tons NO_x per year
CO[c]	$\frac{0.5\text{ lb}}{\text{ton}} \times \frac{\text{ton}}{2,000\text{ lb}} \times \frac{5,945,362\text{ tons}}{\text{yr}}$	1,486 tons CO per year
CO_2[d]	$\frac{5510\text{ lb}}{\text{ton}} \times \frac{\text{ton}}{2,000\text{ lb}} \times \frac{5,945,362\text{ tons}}{\text{yr}}$	16,379,473 tons CO_2 per year
PM[e]	$\frac{10 \times 4.85\text{ lb}}{\text{ton}} \times \frac{\text{ton}}{2,000\text{ lb}} \times (100-99.9/100) \times \frac{5,945,362\text{ tons}}{\text{yr}}$	144 tons PM per year
PM_{10}[e]	$\frac{2.3 \times 4.85\text{ lb}}{\text{ton}} \times \frac{\text{ton}}{2,000\text{ lb}} \times (100-99.9/100) \times \frac{5,945,362\text{ tons}}{\text{yr}}$	33 tons PM_{10} per year

CO = carbon monoxide
CO_2 = carbon dioxide
NO_x = nitrogen oxides
PM = particulate matter
PM_{10} = particulates having diameter less than 10 microns
SO_x = sulfur oxides

a. Ref. 7.2-5, Table 1.1-1.
b. Ref. 7.2-5, Table 1.1-3.
c. Ref. 7.2-5, Table 1.1-2.
d. Ref. 7.2-5, Table 1.1-20.
e. Ref. 7.2-5, Table 1.1-4.

Table 7-4.
Calculation of Solid Waste from Coal-Fired Alternative.

Parameter	Calculation	Result
Annual SO_2 generated[a]	$\frac{0.61}{100} \times \frac{64.1}{32.1} \times \frac{5,945,362 \text{ tons}}{\text{yr}}$	72,497 tons SO_2 per year
Annual SO_2 removed	$74,497 \times \frac{95}{100}$	68,872 tons SO_2 per year
Annual Ash generated	$\frac{4.85}{100} \times \frac{5,945,362 \text{ tons}}{\text{yr}} \frac{99.9}{100}$	288,062 tons ash per year
Annual lime consumption[b]	$(72,497 \text{ton } SO_2) \times \frac{56.1 \text{ ton CaO}}{64.1 \text{ ton } SO_2}$	63,449 tons CaO per year
Annual calcium sulfate generated[c]	$\frac{68,872 \text{ton } SO_2}{\text{yr}} \times \frac{172 \text{ ton } CaSO_4{*}2H_2O}{64.1 \text{ ton } SO_2}$	184,806 tons $CaSO_4{*}2H_2O$ per year
Annual scrubber waste[d]	$\frac{63,449 \text{ton } SO_2 CaO}{\text{yr}} \times \frac{100-95}{100} + 184,806 \text{ ton } CaSO_4{*}2H_2O$	187,978 tons scrubber waste per year
Total volume of scrubber waste[e]	$\frac{187,978 \text{ tons}}{\text{yr}} \times 40 \text{yr} \times \frac{2000 \text{ lb}}{\text{ton}} \times \frac{\text{ft}^3}{144.8 \text{ lb}}$	103,878,310 ft^3 scrubber waste
Total volume of ash generated[f]	$\frac{288,062 \text{ tons}}{\text{yr}} \times 40 \text{yr} \times \frac{2000 \text{ lb}}{\text{ton}} \times \frac{\text{ft}^3}{100 \text{ lb}}$	230,449,380 ft^3 ash
Total volume of solid waste disposed onsite[g]	$103,878,310 + 230,449,380 \text{ ft3} \frac{100-85}{100}$	138,445,717 ft^3 solid waste
Waste pile area (ft^2)	$\frac{138,445,717 \text{ ft}^3}{30 \text{ft high}}$	4,614,857 ft^2 solid waste
Waste pile area (acre)[h]	$4,614,857 \text{ ft}^2 \frac{\text{acre}}{43,560 \text{ ft}^2}$	106 acres of solid waste

S = sulfur
SO_2 = sulfur dioxide
SOx = sulfur oxides
CaO = calcium oxide (lime)
$CaSO_4{*}2H_2O$ = calcium sulfate dehydrate

a. Calculations assume 100 percent combustion of coal.
b Lime consumption is based on total SO_2 generated.
c. Calcium sulfate generated is based on total SO_2 removed.
d. Total scrubber waste generated includes scrubbing media carryover in the waste.
e. Density of $CaSO_4{*}2H_2O$ is 144.8 lb/ft^3.
f. Density of coal bottom ash is 100 lb/ft^3 (Ref. 7.2-25).
g. Assume 85 percent of ash waste is recycled.
h. Assume waste pile height (e.g., 30 ft.).

Table 7-5.
Air Emissions from Gas-Fired Alternative.

Parameter	Calculation	Result
Annual gas consumption	$5\ \text{unit} \times \frac{416\ \text{MW}}{\text{unit}} \times \frac{5,690\ \text{Btu}}{\text{kW x hr}} \times \frac{1,000\ \text{kW}}{\text{MW}} \times 0.85 \frac{\text{ft}^3}{1028\ \text{Btu}} \times \frac{8,760\ \text{hr}}{\text{yr}}$	85,724,610,117 ft^3 per year
Annual Btu input	$\frac{85,724,610,117\ \text{ft}^3}{\text{yr}} \times \frac{1,028\ \text{Btu}}{\text{ft}^3} \times \frac{\text{MMBtu}}{10^6\ \text{Btu}}$	88,124,899 MMBtu per year
SO_x[a]	$\frac{0.0034\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2,000\ \text{lb}} \times \frac{88,124,899\ \text{MMBtu}}{\text{yr}}$	150 tons SO_x per year
NO_x[b]	$\frac{0.0128\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2,000\ \text{lb}} \times \frac{88,124,899\ \text{MMBtu}}{\text{yr}}$	564 tons NO_x per year
CO[b]	$\frac{0.0168\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2,000\ \text{lb}} \times \frac{88,124,899\ \text{MMBtu}}{\text{yr}}$	740 tons CO per year
CO_2[a]	$\frac{110\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2,000\ \text{lb}} \times \frac{88,124,899\ \text{MMBtu}}{\text{yr}}$	4,846,869 tons CO_2 per year
PM[c]	$\frac{0.005\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2,000\ \text{lb}} \times \frac{88,124,899\ \text{MMBtu}}{\text{yr}}$	220 tons filterable PM per year
PM[c]	$\frac{220\ \text{tons TSP}}{\text{yr}}$	220 tons filterable PM_{10} per year

Btu = British thermal units
CO = carbon monoxide
CO_2 = carbon dioxide
MM = million
NO_x = nitrogen oxides
PM_{10} = particulates having diameter less than 10 microns
SO_x = sulfur oxides

a. Ref. 7.2-24.

b. Ref. 7.2-6, Table 3.1-2a.

c. Ref. 7.2-26.

Figure 7-1.
Connecticut Electric Industry Generating Capacity, 2000
(Ref. 7.2-1***, Table 4 and*** Ref. 7.1-3***, Table 4)***

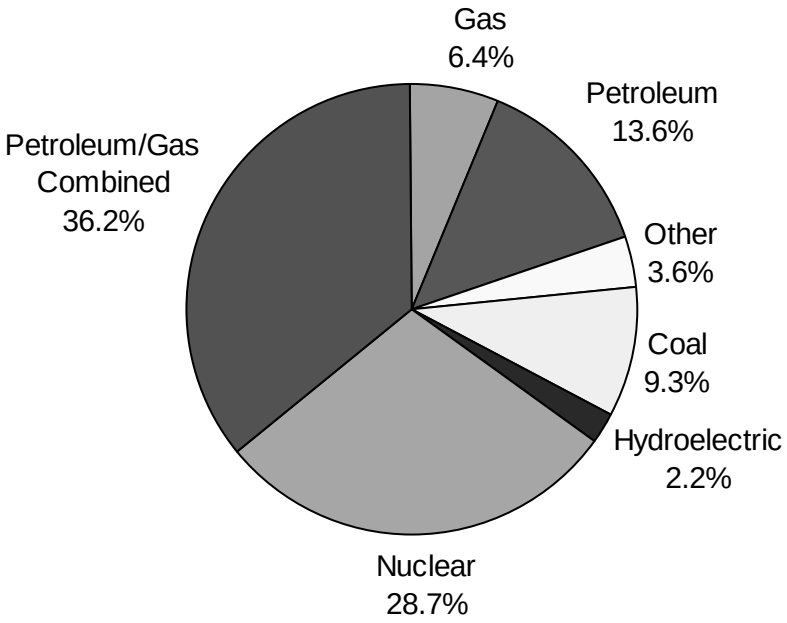
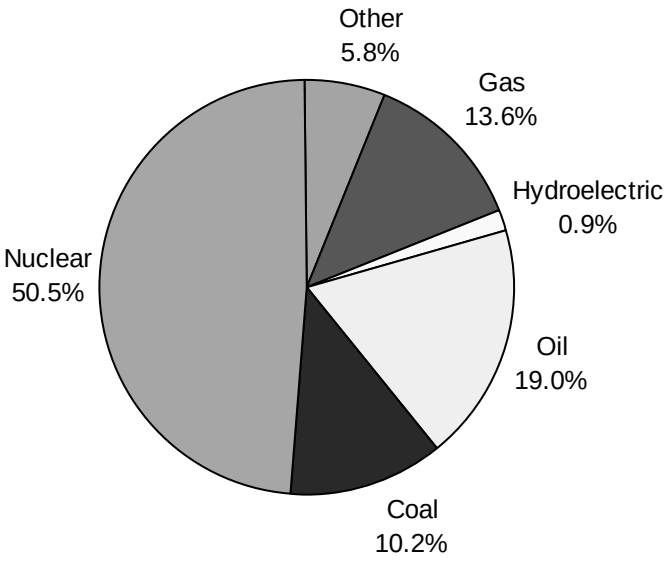


Figure 7-2.
Connecticut Electric Industry Generation, 2001 (Ref. 7.1-2***)***



7.3 References

Note to reader: Some web pages cited in this document are no longer available, or are no longer available through the original URL addresses. Hard copies of all cited web pages are available in DNC files. Some sites, for example the census data, cannot be accessed through their URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by DNC have been given for these pages, even though they may not be directly accessible.

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8.0 COMPARISON OF ENVIRONMENTAL IMPACTS OF LICENSE RENEWAL WITH THE ALTERNATIVES

NRC

"To the extent practicable, the environmental impacts of the proposal and the alternatives should be presented in comparative form;" 10 CFR 51.45(b)(3) as adopted by 51.53(c)(2)

Chapter 4.0 analyzes environmental impacts of Millstone Power Station Units 2 and 3 (MPS) license renewal and Chapter 7.0 analyzes impacts from renewal alternatives. Table 8-1 summarizes environmental impacts of the proposed action (license renewal) and the alternatives, for comparison purposes. The environmental impacts compared in Table 8-1 are those that are either Category 2 issues for the proposed action, license renewal, or are issues that the Generic Environmental Impact Statement (GEIS) (Ref. 8.0-1) identified as major considerations in an alternatives analysis. For example, although the U.S. Nuclear Regulatory Commission (NRC) concluded that air quality impacts from the proposed action would be small (Category 1), the GEIS identified major human health concerns associated with air emissions from alternatives (Section 7.2.2). Therefore, Table 8-1 compares air impacts among the proposed action and the alternatives. Table 8-2 is a more detailed comparison of the alternatives.

Table 8-1.
Impacts Comparison Summary.

Impact	Proposed Action (License Renewal)	No-Action Alternative			
		Base (Decommissioning)	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Land Use	SMALL	SMALL	SMALL	SMALL	MODERATE
Water Quality	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE
Air Quality	SMALL	SMALL	MODERATE	MODERATE	SMALL to MODERATE
Ecological Resources	SMALL	SMALL	SMALL	SMALL	MODERATE
Threatened or Endangered Species	SMALL	SMALL	SMALL	SMALL	SMALL
Human Health	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Socioeconomics	SMALL	SMALL	SMALL	SMALL	SMALL
Waste Management	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Aesthetics	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE
Cultural Resources	SMALL	SMALL	SMALL	SMALL	SMALL

SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource. 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3.

Table 8-2.
Impacts Comparison Detail.

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
MPS license renewal for 20 years, followed by decommissioning	Decommissioning following expiration of current MPS license. Adopting by reference, as bounding MPS decommissioning, GEIS description (Ref. 8.0-1, Section 7.1)	New construction at a hypothetical retired oil-fired facility.	New construction at a hypothetical retired oil-fired facility.	Would involve construction of new generation capacity in the state. Adopting by reference GEIS description of alternate technologies (Section 7.2.1.2)
		Use existing rail spur	Construct 10 miles of gas pipeline. Would use existing rights-of-way when possible.	
		Use existing switchyard and transmission lines	Use existing switchyard and transmission lines	Construct up to 400 miles of transmission lines
		Four 500-MW (net) tangentially-fired, dry bottom unit;	Five 400 MW of net power, consisting of one 280-MW gas-fired combustion turbines and heat recovery capacity of 120 MW. (Combined-cycle turbines to be used.)	
		Existing site intake/ discharge system in compliance with Section 316(b) of Clean Water Act	Existing site intake/ discharge system in compliance with Section 316(b) of Clean Water Act	
		Pulverized bituminous coal, 13,541 Btu/pound; 10,200 Btu/kWh; 4.85% ash; 0.61% sulfur; 10 lb/ton nitrogen oxides; 5,945,362 tons coal/yr	Natural gas, 1,028 Btu/ft^3; 5,690 Btu/kWh; 0.0034 lb sulfur/MMBtu; 0.0128 lb NO_x/MMBtu; 85,724,610,117 ft^3 gas/yr	

Table 8-2.
Impacts Comparison Detail. (Cont.)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
		Low NO_x burners, overfire air and selective catalytic reduction (85-95% NO_x reduction efficiency). Wet scrubber – lime/limestone desulfurization system (80 to 95% SO_x removal efficiency); 63,449 tons limestone/yr Fabric filters or electrostatic precipitators (99.9% particulate removal efficiency)	Selective catalytic reduction	
1,550-1,650 workers		380 workers (Section 7.2.2.1)	55 workers (Section 7.2.2.2)	
Land Use Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 52, 53)	SMALL – Not an impact evaluated by GEIS (Ref. 8.0-1)	SMALL – 300 acres required for the powerblock and associated facilities. (Section 7.2.2.1)	SMALL – 110 acres for facility at existing location; 97 acres for pipeline (Section 7.2.2.2). New gas pipeline would be built to connect with existing gas pipeline corridor.	MODERATE – most transmission facilities could be constructed along existing transmission corridors (Section 7.2.2.3) Adopting by reference GEIS description of land use impacts from alternate technologies (Ref. 8.0-1)

Table 8-2.
Impacts Comparison Detail. (Cont.)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Water Quality Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, 4, 7, 9-12, 32, 37). Five Category 2 water quality issues not applicable (Section 4.1, Issue 13; Section 4.5, Issue 33; Section 4.6, Issue 34; Section 4.7, Issue 35; and Section 4.8, Issue 39).	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 89).	SMALL – Construction impacts minimized by use of best management practices. Operational impacts minimized by use of the cooling water system (Section 7.2.2.1) in compliance with Section 316(b) of Clean Water Act	SMALL – Construction impacts minimized by use of best management practices. Reduced cooling water demands, inherent in combined-cycle design (Section 7.2.2.2), along with compliance with Section 316(b) of Clean Water Act	SMALL to MODERATE – Adopting by reference GEIS description of water quality impacts from alternate technologies (Ref. 8.0-1,)
Air Quality Impacts				
SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 51). Category 2 issue not applicable (Section 4.11, Issue 50).	SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issue 88)	MODERATE – 3,445 to 13,780 tons SO_x/yr 1,486 to 4,459 tons NO_x/yr 1,486 tons CO/yr 16 MM tons CO_2/yr 144 tons TSP/yr 33 tons PM_{10}/yr (Section 7.2.2.1)	MODERATE – 150 tons SO_x/yr 564 tons NO_x/yr 740 tons CO/yr 5 MM tons CO_2/yr 220 tons PM_{10}/yr[a] (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of air quality impacts from alternate technologies (Ref. 8.0-1)

Table 8-2.
Impacts Comparison Detail. (Cont.)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Ecological Resource Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 15-24, 45-48). One Category 2 issue not applicable (Section 4.9, Issue 40). MPS holds a current NPDES permit, which constitutes compliance with Clean Water Act Section 316(b) (Section 4.2, Issue 25; Section 4.3, Issue 26) and 316(a) (Section 4.4, Issue 27)	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 90)	SMALL – 53 acres of forested land could be required for ash/sludge disposal over 20-year license renewal term. (Section 7.2.2.1)	SMALL – Construction of the pipeline could alter habitat. (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of ecological resource impacts from alternate technologies (Ref. 8.0-1)
Threatened or Endangered Species Impacts				
SMALL – With the exception of seasonal roseate tern sightings and limited bald eagle sightings, no federally threatened or endangered species are known at the site or along the transmission corridors. (Section 4.10, Issue 49)	SMALL – Not an impact evaluated by GEIS (Ref. 8.0-1)	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats

Table 8-2.
Impacts Comparison Detail. (Cont.)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Human Health Impacts				
SMALL – Category 1 issues (Table A-1, Issues 58, 61, 62). One category 2 issue does not apply (Section 4.12, Issue 57). Risk due to transmission-line induced currents minimal due to conformance with consensus code (Section 4.13, Issue 59)	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 86)	MODERATE – Adopting by reference GEIS conclusion that risks such as cancer and emphysema from emissions are likely (Ref. 8.0-1)	SMALL – Adopting by reference GEIS conclusion that some risk of cancer and emphysema exists from emissions (Ref. 8.0-1)	SMALL to MODERATE – Adopting by reference GEIS description of human health impacts from alternate technologies (Ref. 8.0-1)
Socioeconomic Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 64, 67). Two Category 2 issues are not applicable (Section 4.16, Issue 66 and Section 4.17.1, Issue 68). Location in high population area with limited growth controls minimizes potential for housing impacts. Section 4.14, Issue 63). Continued plant operation would benefit county (Section 4.17.2, Issue 69). Few additional employees minimizes potential for related impacts (Section 4.15, Issue 65 and Section 4.18, Issue 70)	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 91)	SMALL – Reduction in permanent work force at MPS could adversely affect surrounding counties, but would be mitigated by the site's proximity to Connecticut population centers (Section 7.2.2.1).	SMALL to MODERATE – Reduction in permanent work force at MPS could adversely affect surrounding counties, but would be mitigated by the site's proximity to Connecticut population centers (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of socioeconomic impacts from alternate technologies (Ref. 8.0-1)

Table 8-2.
Impacts Comparison Detail. (Cont.)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Waste Management Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 77-85)	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 87)	MODERATE – 288,062 tons of coal ash and 187,978 tons of scrubber sludge would require 53 acres over 20-year license renewal term. Industrial waste generated annually (Section 7.2.2.1)	SMALL – Almost no waste generation (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of waste management impacts from alternate technologies (Ref. 8.0-1)

SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor notic eably alter any important attribute of the resource. MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource. 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3.

Btu = British thermal unit
ft^3 = cubic foot
gal = gallon
GEIS = Generic Environmental Impact Statement (NRC 1996)
kWh = kilowatt hour
lb = pound
MM = million
MW = megawatt
NO_x = nitrogen oxide
PM_{10} = particulates having diameter less than 10 microns
SHPO = State Historic Preservation Officer
SO_x = sulfur dioxide
TSP = total suspended particulates
yr = year

a. All TSP for gas-fired alternative is PM_{10}.

8.1 References

Ref. 8.0-1 NRC (U.S. Nuclear Regulatory Commission). 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS). Volumes 1 and 2. NUREG-1437. Washington, DC. May.

9.0 STATUS OF COMPLIANCE

9.1 Proposed Action

NRC

"The environmental report shall list all federal permits, licenses, approvals and other entitlements which must be obtained in connection with the proposed action and shall describe the status of compliance with these requirements. The environmental report shall also include a discussion of the status of compliance with applicable environmental quality standards and requirements including, but not limited to, applicable zoning and land-use regulations, and thermal and other water pollution limitations or requirements which have been imposed by Federal, State, regional, and local agencies having responsibility for environmental protection." 10 CFR 51.45(d), as adopted by 10 CFR 51.53(c)(2)

9.1.1 General

Table 9-1 lists environmental authorizations that Dominion Nuclear Connecticut (DNC) has obtained for current Millstone Power Station (MPS) Units 2 and 3 operations. In this context, DNC uses "authorizations" to include any permits, licenses, approvals, or other entitlements. DNC expects to renew all applicable authorizations during the current license period and through the U.S. Nuclear Regulatory Commission (NRC) license renewal period. Based on the new and significant information identification process conducted by DNC (Chapter 5.0), MPS is in compliance with applicable environmental standards and requirements.

Table 9-2 lists additional environmental authorizations and consultations related to the NRC renewal of the MPS licenses to operate. As indicated, DNC anticipates needing relatively few such authorizations and consultations. Section 9.1.2 through 9.1.5 discuss some of these items in more detail.

9.1.2 Threatened or Endangered Species

Section 7 of the Endangered Species Act (16 USC 1531 et seq.) requires Federal agencies to ensure that agency action is not likely to jeopardize any species that is listed or proposed for listing as endangered or threatened. Depending on the action involved, the Act requires consultation with the U.S. Fish and Wildlife Service (FWS) regarding effects on non-marine species, the National Marine Fisheries Service (NMFS) for marine species, or both. FWS and NMFS have issued joint procedural regulations at 50 CFR 402, Subpart B, that address consultation, and FWS maintains the joint list of threatened and endangered species at 50 CFR 17.

Although not required of an applicant by Federal law or NRC regulation, DNC has chosen to invite comment from Federal and state agencies regarding potential effects that MPS license renewal might have. Appendix C includes copies of DNC correspondence with FWS

and the NMFS. In addition, DNC received correspondence from the Connecticut Department of Environmental Protection regarding potential effects on state-listed species; Appendix C also includes copies of this correspondence. As the correspondence indicates, these Federal and State agencies concur with the DNC conclusion that MPS license renewal would not adversely affect threatened or endangered species or critical habitats.

9.1.3 Historic Preservation

Section 106 of the National Historic Preservation Act (16 USC 470 et seq.) requires federal agencies having the authority to license any undertaking to, prior to issuing the license, take into account the effect of the undertaking on historic properties and to afford the Advisory Committee on Historic Preservation an opportunity to comment on the undertaking. Committee regulations provide for establishing an agreement with any State Historic Preservation Officer (SHPO) to substitute state review for Committee review (35 CFR 800.7). Although not required of an applicant by federal law or NRC regulation, DNC has chosen to invite comment by the Connecticut SHPO. Appendix D includes copies of DNC correspondence with the SHPO regarding potential effects that MPS license renewal might have on historic or cultural resources. Based on the DNC submittal and other information, the Connecticut SHPO concurred with DNC's conclusion that MPS license renewal would not affect known historic or archaeological properties.

9.1.4 Coastal Zone Management Program Compliance

The Federal Coastal Zone Management Act (CZMA) (16 USC 1451 et seq.) imposes requirements on applicants for a federal license to conduct an activity that could affect a state's coastal zone. The Act requires the applicant to certify to the licensing agency that the proposed activity would be consistent with the state's federally approved coastal zone management program [16 USC 1456(c)(3)(A)]. The National Oceanic and Atmospheric Administration (NOAA) has promulgated implementing regulations that indicate that the requirement is applicable to renewal of federal licenses for activities not previously reviewed by the state [15 CFR 930.51(b)(1)]. The regulation requires that the license applicant provide its certification to the federal licensing agency and a copy to the applicable state agency (15 CFR 930.57[a]).

The NRC office of Nuclear Reactor Regulation has issued guidance to its staff regarding compliance with the Act (Ref. 9.1-1, Appendix E). This Guidance acknowledges that Connecticut has an approved coastal zone management program. MPS, located in New London County, is within the Connecticut coastal zone (Ref. 9.1-2). Concurrent with submitting the Applicant's Environmental Report – Operating License Renewal Stage to NRC, DNC will submit a copy of the Environmental Report, including the Coastal Zone Consistency Certification (Appendix E of this document) to Connecticut in fulfillment of the

regulatory requirement for submitting a copy of the coastal zone consistency certification to the state.

9.1.5 Water Quality (401) Certification

Federal Clean Water Act Section 401 requires applicants for a federal license to conduct an activity that might result in a discharge into navigable waters to provide the licensing agency a certification from the state that the discharge will comply with applicable Clean Water Act requirements (33 USC 1341). State of Connecticut regulations (Sec22a-430) require that any entity discharging to waters of the state must have a permit to do so issued by the Commissioner of the Department of Environmental Protection (DEP). And further, that the Commissioner may not issue such a permit unless the discharge is in accordance with the provisions of the federal Clean Water Act (33 USC 1251 et seq.). The Section 401 Water Quality Certification for the operation of the Millstone Power Station was issued on April 19, 1974. Subsequently, Millstone Power Station has received a permit to discharge to the waters of the state, and therefore is in compliance with the federal Clean Water Act.

9.2 Alternatives

NRC

"The discussion of alternatives in the report shall include a discussion of whether the alternatives will comply with such applicable environmental quality standards and requirements." 10 CFR 51.45(d), as required by 10 CFR 51.53(c)(2)

The coal, gas, and purchased power alternatives discussed in Section 7.2.1 probably could be constructed and operated to comply with all applicable environmental quality standards and requirements. DNC notes that increasingly stringent air quality protection requirements could make the construction of a large fossil-fueled power plant infeasible in many locations. DNC also notes that the U.S. Environmental Protection Agency has revised requirements that could affect the design of cooling water intake structures for new facilities (Ref. 9.2-3) and proposed requirements that could affect existing facilities (Ref. 9.2-4). These requirements could necessitate construction of cooling towers for coal- and gas-fired alternatives if surface waters were used for cooling.

Table 9-1.
Environmental Authorizations for Current Millstone Units 2 and 3 Operations.

	Agency	Authority	Requirement	Number	Pertinent Dates	Activity Covered
			Federal			
1.	U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011, et seq.), 10 CFR 50.10	License to Operate	DPR – 65	Issued 09/26/75 Expires 07/31/15	Operation of Unit 2
2.				NPF – 49	Issued 01/31/86 Expires 11/25/25	Operation of Unit 3
3.	U.S. Department of Transportation	49 USC 5108	Registration	061202550034KL	Issued 06/13/02 Expires 06/30/04	Shipment of hazardous materials
4.	U.S. Fish and Wildlife Service	Migratory Bird Treaty Act 16 USC 703-712	Depredation Permit	MB728673-0	Issued 11/07/03 Expires 10/31/04	Removal of birds, eggs and nests from utility structures, property
5.	U.S. Department of Army, Corps of Engineers	Section 10, River and Harbor Act (33 USC 403)	Permit	CT-NIAN-78-507	Issued 10/11/78 No expiration date	Install and maintain sandbag dike for ecology laboratory mariculture work
6.	U.S. Department of Army, Corps of Engineers	Section 10, River and Harbor Act (33 USC 403)	Permit	CT-NIAN-77-377 (LOP)	Issue 09/19/77 No expiration date	Install and maintain ecology laboratory seawater intake pipes
			State			
7.	Connecticut Department of Environmental Protection (CDEP)	CGS 4-182, 22a-430, 22a-430-1 et seq.	NPDES permit	CT0003263	Issued 12/14/92 Renewal application submitted 6/13/97	Discharges to Long Island Sound
8.	CDEP	CGS 22a-430b	General Permit for stormwater discharges associated with industrial activities	GSI001430	Issued 09/25/03 Expires 10/01/07	Stormwater discharges; industrial activities

Table 9-1.
Environmental Authorizations for Current Millstone Units 2 and 3 Operations. (Cont.)

	Agency	Authority	Requirement	Number	Pertinent Dates	Activity Covered
9.	CDEP	CG 22a-6K	Emergency Authorization	EA 0100176	Issued 10/13/00 Transferred 3/31/01	Discharges to Long Island Sound
10.	CDEP	CGS 22a-430	General Permit for Discharge of Minor Photographic Processing Wastewater	GPH000354	Issued 10/20/95 Expires 10/20/05	Discharge of minor photographic process wastewater to municipal sewer
11.	CDEP	CGS 22a-430	General Permit for the Discharge of Water Treatment Wastewater	GWT 000175	Issued 03/26/01 Expires 05/01/05	Water treatment wastewater
12.	CDEP	CGS 22a-430	General Permit for Miscellaneous Discharges of Sewer Compatible Wastewater	GMI000012	Issued 03/13/02 Expires 04/30/11	Wastewater discharges from Fire Training Facility
13.	CDEP	Ct. P.A. 82-402, Section 4	Registration	2000-018-PWR-SU (Unit 2)	Issued 07/12/83 Transferred on 03/31/01 No expiration date	Divert large volume of water from Long Island Sound for steam condenser cooling water
14.	CDEP	Ct. P.A. 82-402, Section 4	Registration	2000-019-PWR-SU (Unit 3)	Issued 07/12/83 Transferred on 03/31/01 No expiration date	Divert large volume of water from Long Island Sound for steam condenser cooling water
15.	CDEP	CGS 22a-174	Permit	199-0003-0043	Issued 08/10/00 No expiration date	Emissions from fire training mock-up facility and two propane-fired water pumps
16.	CDEP	CGS 22a-174	Permit	199-0003-0044	Issued 04/27/99 No expiration date	Emissions from diesel-fired trash water pump

Table 9-1.
Environmental Authorizations for Current Millstone Units 2 and 3 Operations. (Cont.)

	Agency	Authority	Requirement	Number	Pertinent Dates	Activity Covered
17.	CDEP	CGS 22a-174	Permit	199-0003-0045	Issued 04/27/99 No expiration date	Emissions from diesel-fired motorpool air compressor
18.	CDEP	CGS 22a-174	Permit	199-0003-0046	Issued 04/27/99 No expiration date	Operate diesel-fired motorpool air compressor
19.	CDEP	CGS 22a-174	Permit	199-0004-0056	Issued 11/09/99 No expiration date	Emissions from Unit 2 emergency diesel generator (1 of 2)
20.	CDEP	CGS 22a-174	Permit	199-0003-0055	Issued 11/09/99 No expiration date	Emissions from Unit 2 emergency diesel generator (2 of 2)
21.	CDEP	CGS 22a-174	Permit	199-0003-0007	Issued 01/24/86 No expiration date	Emissions from Unit 3 auxiliary boiler (1 of 2)
22.	CDEP	CGS 22a-174	Permit	199-0003-0008	Issued 01/24/86 No expiration date	Emissions from Unit 3 auxiliary boiler (2 of 2)
23.	CDEP	CGS 22a-174	Permit	199-0003-0009	Issued 05/21/85 No expiration date	Emissions from Unit 3 emergency diesel generator (1 of 2)
24.	CDEP	CGS 22a-174	Permit	199-0003-0010	Issued 05/21/85 No expiration date	Emissions from Unit 3 emergency diesel generator (2 of 2)
25.	CDEP	CGS 22a-174	Permit	199-0003-0017	Issued 08/25/92 No expiration date	Emissions from station blackout emergency diesel generator (3 of 3)
26.	CDEP	CGS 22a-174	Permit	199-0003-0051	Issued 05/27/99 No expiration date	Emissions from Unit 3 ESF diesel compressor (1 of 3)

Table 9-1.
Environmental Authorizations for Current Millstone Units 2 and 3 Operations. (Cont.)

	Agency	Authority	Requirement	Number	Pertinent Dates	Activity Covered
27.	CDEP	CGS 22a-449	Notification	Site ID 170-8414	Submitted 03/27/01 No expiration date	Unit 3 emergency generator underground storage tank E6, #2 diesel oil
28.	CDEP	CGS 22a-449	Notification	Site ID 170-8414	Submitted 03/27/01 No expiration date	Unit 3 emergency generator underground storage tank E7, #2 diesel oil
29.	CDEP	CGS 22a-449	Notification	Site ID 170-8414	Submitted 03/27/01 No expiration date	Unit 3 auxiliary boiler underground storage tank F8, #4 heating oil
30.	CDEP	CGS 22a-449	Notification	Site ID 170-8414	Submitted 03/27/01 No expiration date	Unit 3 auxiliary boiler underground storage tank F9, #4 heating oil
31.	CDEP	CGS 22a-449	Notification	Site ID 170-8425	Submitted 03/27/01 No expiration date	Simulator building underground storage tank, #2 heating oil
32.	CDEP	CGS 22a-449	Notification	Site ID 170-8486	Submitted 03/27/01 No expiration date	Unit 2 emergency diesel underground storage tank, #2 fuel oil. This tank has been retired.
33.	South Carolina Department of Health and Environmental Control	South Carolina Radioactive Waste Transportation and Disposal Act (Act No. 429 of 1980)	Permit	0013-06-04	Issued 12/10/03 Expires 12/31/04	Transport radioactive wastes

Table 9-1.
Environmental Authorizations for Current Millstone Units 2 and 3 Operations. (Cont.)

	Agency	Authority	Requirement	Number	Pertinent Dates	Activity Covered
34.	Tennessee Department of Environment and Conservation	Rule 1200-2-10.32	License	T-CT003-L04	Issued 12/02/03 Expires 12/31/04	Ship radioactive materials
35.	CDEP	CGS 26-60	Scientific Collector Permit	219	Issued 01/17/03 Expires 01/16/06	Collect fish and lobsters
36.	CDEP	CGS Title 22a, Chapter 445	Permit	not applicable	Part A application submitted 12/22/00	Store radioactive hazardous (i.e., mixed) waste
37.	CDEP	CGS 22a-174	Permit	199-0038-TV	Issued 01/29/03 Expires 01/29/08	Emissions (Title V permit)

Note: Federal and state agencies have issued numerous other construction permits at Millstone Power Station, and Dominion Nuclear Connecticut secures additional regulatory agency approvals as needed for short-term activities such as dredging. Table 9-1 lists only permits that apply to current operations.

CGS = Connecticut General Statutes
CDEP = Connecticut Department of Environmental Protection
ESF = Engineered Safeguards Features
NPDES = National Pollutant Discharge Elimination System

Table 9-2.
Environmental Authorizations for Millstone Units 2 and 3 License Renewal.[a]

Agency	Authority	Requirement	Remarks
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011 et seq.)	License renewal	Environmental Report submitted in support of license renewal application
Fish and Wildlife Service and National Marine Fisheries Service	Endangered Species Act Section 7 (16 USC 1536)	Consultation	Requires Federal agency issuing a license to consult with FWS and NMFS (Appendix C)
Connecticut Department of Environmental Protection	Clean Water Act Section 401 (33 USC 1341)	Certification	Certification issued 04/19/74. Ongoing compliance through NPDES permit.
Connecticut Historical Commission	National Historic Preservation Act Section 106 (16 USC 470f)	Consultation	Requires Federal agency issuing a license to consider cultural impacts and consult with State Historic Preservation Officer (SHPO). (Appendix D)
Connecticut Department of Environmental Protection, Office of Long Island Sound Programs	Federal Coastal Zone Management Act (16 USC 1451 et seq.)	Certification	Requires an applicant to provide certification to the federal agency issuing the license that license renewal would be consistent with the federally-approved state coastal zone management program. Based on its review of the proposed activity, the state must concur with or object to the applicant's certification. (Appendix E)

a. No renewal-related requirements identified for local or other agencies.

9.3 References

Note to reader: Some web pages cited in this document are no longer available, or are no longer available through the original URL addresses. Hard copies of all cited web pages are available in DNC files. Some sites, for example the census data, cannot be accessed through their URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by DNC have been given for these pages, even though they may not be directly accessible.

Ref. 9.1-1 NRC (U.S. Nuclear Regulatory Commission). 2001. Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues, NRR Office Instruction. LIC-203. June 21.

Ref. 9.1-2 Connecticut General Assembly. 1979. Chapter 444. Coastal Management. Section 22a-94. Coastal area; coastal boundary. Available at http://www.cga.state.ct.us/2001/pub/chap444.htm. Accessed June 25, 2002.

Ref. 9.2-3 EPA (U.S. Environmental Protection Agency). 2001. "National Pollutant Discharge Elimination System: Regulations Addressing Cooling Water Intake Structures for New Facilities; Final Rule." Federal Register. Vol. 66. No. 243. December 18.

Ref. 9.2-4 EPA (U.S. Environmental Protection Agency). 2002. "National Pollutant Discharge Elimination System – Proposed Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities; Proposed Rule." Federal Register. Vol. 67. No. 68. April 9.